THE BRITISH JOURNAL
OF
OPHTHALMOLOGY
AUGUST, 1939

COMMUNICATIONS

THE INTRA-CAPSULAR EXTRACTION OF CATARACT WITH FORCEPS: IS ITS USE JUSTIFIABLE?*

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Summary of Contents

(1) Historical and general considerations.
(2) Certain complications: their incidence, causes and avoidance.
(3) Choice of cases.
(4) Important details of technique.
(5) Summary and conclusions.
(6) References.

(1) Historical and General Considerations

THERE has been much writing of recent years on the subject of intra-capsular extraction of cataract, some of which is controversial. Some authors allow their enthusiasm to distort the facts; statistics of comparisons with the classical method are uncommon; the variety of operative details recommended is immense; it is thus difficult for an ophthalmic surgeon to come to any satisfactory conclusions on the subject. Before discussing the intra-capsular operation with forceps, it is of interest to study briefly the history of the operation.

Daviel is reputed to have been the first to remove the cataractous

* Thesis for M.D. degree, University of Cambridge.

lens from the eye in 1745 and the technique was described by Pellier de Quensy in 1851. However, Alexander in 1929 brought evidence to prove the great antiquity of the removal of cataract from the eye. " One of the four kings mentioned in Genesis XIV, I, as being contemporary with Abraham, Amraphael, is on general consent, identified with the Babylonian King Khammurabi, of profane history, who was famous, among other things, for his code of laws. Of these laws, No. 215 reads as follows : " If a physician has opened the cataract of a man, with a bronze lancet, and cured the eye of the man, he shall receive 10 shekels of silver." From law 218, it would seem likely that steps conducive to safety were taken, as this law reads : " If a physician has opened the cataract of a man with a bronze lancet, and destroyed the eye, his hands will be cut off." Now Khammurabi reigned just over 2,000 B.C., and as at his time the operation was obviously an established one, it may have been done long before then.

In 1753, Samuel Sharp described his intra-capsular operations performed in that year. Ritcher, in 1773, dislocated the lens into the anterior chamber by a needle and afterwards removed it through a corneal section. Moreheim, in 1781, Beer, in 1799, and Christiansen, in 1845, suggested intra-capsular extraction. Alexander Pagenstecher wrote on the subject in 1866, as did also his brother Hermann. In 1895, Col. Smith began his work at Jullundur, and developed the intra-capsular extraction on his well-known lines. Probably Terson, in 1871, was the first to grasp a fold of the capsule with forceps and deliver the lens by traction.

In 1910, Kalt devised a pair of blunt forceps known by his name and these have been used by Knapp (from 1911 onwards) and many others for the operation. In 1910 and 1911, Stanculeanu and his assistant performed 240 extractions with a special pair of forceps, and Török in New York and Elschnig in Prague started employing the operation. Barraquer, in 1916, devised an instrument on the vacuum principle, known as the erisophake. A further variation of the intra-capsular technique is electro-coagulation of the lens.

Of these various methods of intra-capsular extraction, namely Smith's expression method, Barraquer's suction method, electro-coagulation of the lens and forceps extraction, I propose to deal with the last. It would take much space to compare these methods and the technique of the forceps method is probably the easiest to acquire and, as Kirwan recently stated, the least dangerous.

St. Martin compares the different methods in detail. He regards Smith's method as too dangerous for civilised countries and finds that there is not much to choose between Barraquer's method and forceps extraction and that the skill of the individual operator is a very important factor. He prefers Barraquer's method, as being

less likely to cause rupture of the capsule and iris prolapse and because there are more types of cataract suitable for this method than for forceps extraction. However, the apparatus has to work perfectly to give good results.

It is the object of this paper to attempt to set out the indications for the operation and to describe in detail an operative technique. The substance of the paper is derived from a study of the recent literature on the subject, from personal experience of 1,556 cataract extractions (of which two-thirds were intra-capsular) at Shikarpur and Karachi Eye Hospitals (including 96 extractions in one day) and from visits to clinics at Budapest, Edinburgh, Oslo and Vienna. No attempt will be made to prove that, in selected cases, the operation should supercede the classical operation. This is the subject of much controversy and will, no doubt, continue so for many years to come. To-day is not the moment to try to come to any conclusions on this point.

It seems likely that in certain countries where operating conditions are far from ideal, *e.g.*, in certain parts of India, it will continue to be the operation of choice in selected cases. If an extra-capsular extraction is done, so often patients return to their own homes with an after-cataract and are never seen again. Further, the conditions of native life, the great number of cases and perhaps the physical differences incidental to race and climate, render the problem of cataract extraction in such places very different and an operation giving good results but carrying a greater risk of complications seems justifiable. The advantages of a quicker convalescence and no second operation are very important in such places.

Wright has recently written that, even after years of consideration and vast experience, it is uncertain whether intra-capsular extraction is better than extra-capsular when the latter is really well done, even when conditions for the former are favourable. He remarks that an eye with its zonule-capsule barrier intact, provided that the vision is good, is, *prima facie*, a better eye than one in which it is not intact.

Duke-Elder writes that before a considered opinion can be given, more extensive and accurate information as to end-results is required.

McAndrews quotes Kalt as saying that the ideal method of cataract extraction is by capsulectomy and that this is preferable to intra-capsular extraction. The necessity for a capsulotomy afterwards has disappeared in his practice.

As Zentmayer says, " the utility of an operation procedure must be estimated, not by the technique and results of its most skilful interpreter, but by those likely to be attained by a surgeon of average ability."

There is good reason for the attitude of many surgeons, which may be expressed as follows: if cataract extraction by the classical method, possibly using capsulectomy and anterior chamber irrigation, gives satisfactory visual results, it is not justifiable to subject the patient to an operation which is rather more risky although visual results in uncomplicated cases may be excellent; further, that the risks attached to the needling operation, which is only needed in a small percentage of cases, is very small compared with the risks of the intra-capsular operation.

As regards visual acuity, 6/6 and J.I occur frequently after the extra-capsular operation. Further, the majority of people operated on for senile cataract have retired from everyday life and if a patient can see 6/12 and read small print afterwards, he is usually delighted with the results.

Generally speaking, the advantages of the operation are well known. In uncomplicated cases, the visual results are rather better, the convalescence is shorter and smoother owing to absence of reaction, no posterior capsulotomy is needed afterwards, there is less tendency to post-operative iritis and immature cataract is especially suitable. The disadvantages are that it is a more difficult and delicate operation and vitreous prolapse is more likely.

Some recent comparisons between the end-results of the intra-capsular forceps operation and the classical operation are important. Statistics of these are not common in the literature and not until many more are forthcoming and the cases for intra-capsular extraction carefully selected, can any final conclusions be reached.

Sinclair, in 1932, stated that, after following up cases over a period of years, he had no doubt as to the superiority of intra-capsular extraction, especially in immature cataract.

W. R. Parker, in 1934, studied the case histories from Prof. Meller's Clinic. Only successful intra-capsular cases were included (*e.g.*, ruptured capsule cases were excluded). Excellent vision (6/8 or better) was reached in 91 per cent. of the intra-capsular cases and 94 per cent. of the extra-capsular cases. However, in two cases of intra-capsular extraction, the vision was permanently lost, one from dystrophic keratitis following traumatic opacity of the cornea and the other from secondary glaucoma, following mild iritis. The extra-capsular extractions were done by capsulectomy and only 6·9 per cent. needed a posterior capsulotomy afterwards. The conclusions reached were that, while the results of a successful intra-capsular operation are practically as good as those of the extra-capsular operation, the number of unsatisfactory results was greater in a selected series of cases of the former than in an unselected series of the latter cases.

Appleman, in April, 1938, reported on 146 intra-capsular cases compared with 104 of the classical operation, in all of which there

were no complications. Vision of 6/12 or better was reached in 67 per cent. of the former and 77 per cent. of the latter, giving an advantage of 10 per cent. in favour of the extra-capsular method. There were, however, more cases in which 6/6 was reached in the intra-capsular method (37 out of 146) than in the extra-capsular method (20 out of 104). (Most operators would consider these results very poor indeed.) Nevertheless, in the same report he mentions 18 cases with complications; in 13 of these, the intra-capsular operation was done and in 5, the extra-capsular. Twelve out of 13 of the former were failures owing to the following: iridocyclitis leading to phthisis bulbi (2 cases), haemorrhage followed by panophthalmitis (2 cases), detachment of the retina (1 case), detachment of the choroid (1 case), macular choroiditis (1 case), cardiac failure with sudden death (2 cases), considerable loss of vitreous (2 cases).

All the five cases of complications after extra-capsular extraction were deemed failures because of the following: iridocyclitis (1 case), central retino-choroiditis (1 case), optic atrophy secondary to cataract with secondary glaucoma (2 cases), and chronic myocarditis with sudden death, 11 days after operation, the eye being in good condition.

McDonald, in 1938, reported on 156 aphakic eyes examined by the slit-lamp, three to five years after operation, some of which were intra-capsular extractions. No changes were found in the hyaloid membrane suggestive of increasing density. In most cases, the visual acuity was the same or better than that found at the original refraction.

The incidence of certain complications of the intra-capsular operation is important. If it could be shown that the incidence of complications likely to impair the final visual results is higher, even in cases specially selected for the intra-capsular operation, than in the extra-capsular operation, then there would be a strong argument against ever performing the intra-capsular operation.

In the ensuing writing, many controversial points are raised, and a detailed discussion of many of them has not been attempted, as it would take up too much space.

(2) Certain Complications: Their Incidence, Causes and Avoidance

Ruptured Capsule.—This complication is common and unpleasant for various reasons. Some hold that it is not serious, the condition being similar to that which occurs in capsulectomy. This only holds true if the capsule bursts at an early stage in the tumbling operation. If it occurs when the suspensory ligament is only partly broken and masses of soft lens matter escape or,

worse still, if vitreous prolapse occurs, it is a very unpleasant complication, as a dense after-cataract forms.

Recent statistics reveal the incidence of the complication as being between 3 per cent. and 45 per cent. of cases, commonly about 20 per cent. In about half or more of these cases, the capsule can be separately removed after the lens is delivered. Prolapse of vitreous is likely if this removal is not carried out with extreme care. Sometimes the hyaloid membrane is adherent to the posterior lens capsule and it is in these cases, which, unfortunately, cannot be recognised beforehand, that prolapse of vitreous may occur, either as the lens tumbles, or as the capsule ruptures. Wright says that if ruptured capsule occurs with vitreous prolapse, it is one of the worst catastrophes that can happen during the intra-capsular operation. An attempt should be made to remove the capsule, but it may be left behind if cortex is not present as well.

A ruptured capsule brings the risk of iritis, secondary glaucoma or generalised infection of the eye, as in the extra-capsular operation, if the capsule is neither satisfactorily left *in situ* nor removed before toilet of the iris. The incidence of this complication varies according to (1) the type of cataract; (2) the type of forceps; (3) the age of the patient; (4) the operator's technique and skill.

Castroviejo held that there was a decreasing chance of success in the following list:—(1) soft cataract; (2) immature cataract and uncomplicated cataract; (3) nuclear cataract; (4) Morgagnian cataract; (5) black cataract; (6) intumescent cataract.

Kadlicky in a series of 200 cases had the complication in 10 per cent. of hard cataracts, 11 per cent. of nuclear sclerosis and 30 per cent. of immature cataracts. The age of the patients, however, was not mentioned. With complicated cataract, it is more likely to occur, the capsule rupturing rather than the posterior synechiae.

St. Martin quotes that Elschnig's forceps caused the complication in 22 per cent. of cases and Kalt's forceps in 47 per cent. The type of forceps recommended is mentioned below.

Kalt, in 1933, said that it is not possible to tell which capsule will rupture but that older cataracts are best. The important factors of the type of cataract and age of the patient are discussed below.

St. Martin holds that the tumbling method is less likely to cause ruptured capsule than the head-on method, for in the latter the traction has to be exerted against the whole zonule and not in one area, as in the tumbling method.

The importance of attention to technical details may be emphasised here, for any conditions which hinder the delivery of the lens are likely to cause rupture of the capsule. These

include a too small corneal section; a section finishing in the cornea and not at the limbus; a relatively large lens with a relatively small cornea; mydriasis less than 7 mm.; the use of unsuitable forceps; careless introduction of the forceps; grasping a piece of capsule more or less than 2·5 mm. wide; hurrying the lens extraction, both before and after the lens has started to tumble; too much traction instead of pressure from below when the lens has started to tumble.

Vitreous Prolapse.—Wright says that the longer one practises cataract extraction, the more definitely one forms the opinion that an uncontrolled fluid vitreous or a normal vitreous, which, herniating freely, adheres to the iris face or is caught up by broad bands to the section or a vitreous which escapes through the section and forms a gross impaction, are varying degrees of a very undesirable complication.

Some authors are apt to minimise this complication, describing the vitreous loss as " only a bead " or " only fluid vitreous." Foster Moore has aptly remarked that there are beads of all sizes and that to him the complication is one of the worst that can occur. It predisposes to infection, iridocyclitis, secondary glaucoma, vitreous degeneration which may diminish visual acuity, probably detachment of the retina, choroidal haemorrhage and, according to Knapp, a toxic optic neuritis.

Arruga quotes this complication as occurring in 2·5 per cent. of cases, Elschnig 3·4 per cent. in myopes and 1·5 per cent. in non-myopes; Blascovics in 1·5 per cent., de Grosz, in 1937, in 2 per cent. of intra-capsular extractions.

Parker quotes 6 per cent. compared with 2 per cent. in the combined extra-capsular extraction and 3·3 per cent. in simple extra-capsular extraction.

St. Martin quotes 11 cases of expulsive haemorrhage, of which 6 had prolapse of vitreous at operation. However, he does not think that the method of extraction affects the incidence of expulsive haemorrhage.

Knapp, in 1936, quoted 8 per cent. of vitreous loss in 500 cases, in the last 100 of which it was 5 per cent.

In my paper on Holland's Hospital at Shikarpur, I quoted 4·2 per cent. vitreous prolapse in Smith's intra-capsular method, 4·9 per cent. in forceps extraction by tumbling and 1·8 per cent. in extra-capsular cases.

Prolapse of vitreous may occur (*a*) immediately after the corneal section; (*b*) during subluxation of the lens; (*c*) immediately after delivery of the lens or (*d*) at the end of the operation. (*a*) is not discussed here, as it is unconnected with the intra-capsular technique. Vitreous prolapse with (*b*) and (*c*) may be due to faulty choice of cases or faulty technique, *e.g.*, in old people with

fluid vitreous, in complicated cataract, traumatic cataract or with high myopia, or if too much force is exerted or the operation hurried. Prolapse with (*c*), however, sometimes happens independently of all faults in technique and choice of cases and is probably due to the hyaloid membrane being adherent to the posterior lens capsule. Unfortunately, these cases cannot be discovered beforehand. Prolapse with (*d*) is likely to occur from unskilful attempts to replace capsule or iris, in the event of ruptured capsule.

The question as to whether the tumbling or head-on method of delivery is preferable is debatable. Some exponents, such as Arruga, Elschnig, Knapp, Sinclair, Török and Traquair favour the former, and others, including de Grosz and Verhoeff, the latter. It is believed that the tumbling method is less likely to cause prolapse of vitreous, owing to the fact that the lens acts as a plug to the wound until it is delivered. Further, it possesses the great advantage that, in the event of the capsule rupturing early, there is a clear gap in the capsule below. A third important advantage is that in the event of ruptured capsule, capsular tags will not be caught up to the incision, assuming, as is often the case, that a complete iridectomy has not been done.

St. Martin remarks that, although it is apparently more difficult and dangerous, the tumbling method shows itself to be more inoffensive than the head-on method and at the same time much more efficacious. On the other hand, the supporters of the head-on method say that this method is especially well safeguarded against loss of vitreous, for the lens is kept pressed against the posterior lip of the wound. Further, the traction from above stretches the lower zonular fibres and thus reduces the pressure on the vitreous exerted by the strabismus hook.

It is probable that some cases are more suitable for one method than the other. Hagen of Oslo recommended the tumbling method, except in elderly patients and those with hard cataracts. These do not tumble easily and for them he recommended the head-on method with complete iridectomy. Safar and Blascovics do the same with cataracts in old people. Stallard recommends the head-on method for complicated cataract following irido-cyclitis, provided that a preliminary iridectomy is done and the posterior synechiae are easily ruptured by sweeps from an iris repositor.

There is a large number of statistics on the subject of vitreous loss and, in general, it may be said that vitreous loss is higher in the intra-capsular operation than the extra-capsular and probably slightly higher in the head-on method than in the tumbling method; a careful choice of patients and attention to details of technique, however, will substantially reduce this highly undesirable complication.

Corneal Opacities.—This complication is one which is com-

paratively common in intra-capsular work. Wright classifies corneal opacities into three degrees:—(1) associated with change in the endothelium; (2) associated with change in Descemet's membrane (3) associated with change in the substantia propria.

Knapp describes keratitis, associated with cyclitis, as the most serious complication which occurs in intra-capsular work. He quotes three cases:—One had no complication during operation and the final vision was 5/200; in another, slight difficulty occurred in the delivery of the lens, followed by a deep corneal opacity with wrinkling of Descemet's membrane which became worse and the eye was lost; a third had a deep opacity of the cornea after no apparent complications at the operation and this became worse with deep corneal vessels, also optic neuritis and haemorrhages and the final vision was perception of light. He states that the latter case which also had evidence of cyclitis, may have been due to the patient's poor health or trauma or both.

Stallard states that a mild degree of striate keratitis may occur after using the corneo-scleral stitch and generally clears up in 8-10 days, leaving no ill-effect. He says, further, that it is not so severe as the striate keratitis which sometimes occurs after extra-capsular cataract extraction, when a corneo-scleral stitch has not been used.

St. Martin says that one cannot attribute striate keratitis entirely to trauma. He has seen cases in which the cornea remains clear after contact with curettes, spatulae and irrigation fluid, while others show an opacity after no manipulations at all. He says that the opacity is due to wrinkling of Descemet's membrane and does not influence the final visual acuity.

Glaucoma.—It is sometimes believed that glaucoma is more likely to occur after the intra-capsular operation. It is probable that if the operation is uncomplicated, post-operative glaucoma is less likely. Iridocyclitis, caused by lens matter, is absent and there is no capsule to be caught up in the incision. If, however, intra-capsular extraction is complicated by ruptured capsule or prolapse of vitreous, glaucoma may follow.

St. Martin quotes 36 cases of vitreous in the pupil, examined several months afterwards:—In 6 cases the hyaloid ruptured, but no rise of tension occurred in any case; in 30 cases of vitreous hernia without hyaloid rupture, only 4 had increased tension. He quotes cases mentioned by various authors, in which the cause of increased tension was a fragment of capsule in the wound.

Sinclair considers that adhesions between the pupil and hyaloid membrane are especially dangerous in this way, and recommends atropine after 24 hours to prevent them.

Barraquer believes that vitreous prolapse, reaching the incision, is one of the most common causes of post-operative glaucoma.

Knapp believes that glaucoma is less frequent in intra-capsular

than extra-capsular extraction. He observed the condition in 14 out of 500 cases. In 4, it appeared some time, usually several years, after operation; in 6, the disease had been present before and was relieved by the operation. In 4 cases, in which glaucoma was present before, the glaucoma returned after the cataract extraction, and required treatment.

Hyphaema.—It is probable that there is a rather greater likelihood of hyphaema in intra-capsular extraction than in extra-capsular. Knapp quotes O'Brien as saying that hyphaema is the most common complication; further, that it occurs almost invariably on the 5th day, but occasionally at other times. He states that in his 5th hundred of intra-capsular cases, hyphaema occurred in 9 per cent. He suggests that it may be due to adrenalin in the retro-orbital injection.

St. Martin discusses the question, and concludes that it is not due to adrenalin in the retro-orbital injection. He quotes two series of 50 unselected cases. In the first series adrenalin was not used: hyphaema occurred in 10 per cent.; in the second, it was used: there were 6 per cent. Further, he finds that hyphaema is more common after extra-capsular extraction, *viz.*: 10 per cent. of 50 cases, than after the intra-capsular operation, *viz.*: 6 per cent. of 50 cases.

The haemorrhage is alleged to invade the vitreous. St. Martin finds that this is so only when the hyaloid membrane is ruptured. Such a haemorrhage is absorbed fairly quickly, although much more slowly than from the aqueous. Rarely he found that it invaded the whole vitreous, but the prognosis was favourable, except in one case. He finds hyphaema occurring from the 3rd to the 7th day.

Sinclair quotes the complication in 7 per cent. of cases and found that the complication prolonged convalescence, but otherwise had no ill-effect.

Duthie reports hyphaema in 28 per cent. of cases. In all severe cases it occurred on the 4th, 5th or 6th day; its average duration was 13 days. In almost every case, there was a history of trauma, but only the mild type of trauma which produces no haemorrhage in extra-capsular cases. In one case only, with corneal blood-staining and final vision 6/12, was there any interference of vision.

Stallard, who is strongly in favour of the corneo-scleral suture as a preventative against hyphaema, since the latter may be due to small movements of the wound edges, states that in 28 cases of intra-capsular extraction in which this stitch was used, there was no case of hyphaema. A hyphaema prolongs convalescence, it may endanger sight by causing occlusio pupillae, blood-staining of the cornea and secondary glaucoma in severe cases, and, in milder cases, it may irritate the eye for weeks.

Iritis and Iridocyclitis.—There is less likelihood of these complications in an uncomplicated intra-capsular operation, for cortical remnants and capsular tags which may cause trouble, are absent.

Knapp reports mild cases, medium cases with synechiae, updrawn pupil and thickened hyaloid membrane, and, finally, a severe type. The latter is characterised by the failure of the anterior chamber to reform, the development or persistence of a deep corneal opacity, followed by corneal vascularisation, chronic iridocyclitis and, later, glaucoma. He quotes 5 cases of this complication (out of 500) and believes the condition to be due to traction on the ciliary body. He believes that if, on reasonable traction, the cataract does not dislocate readily, the procedure should be abandoned. He thinks that it must be traumatic in origin, although, at the same time, certain eyes and patients with constitutional disturbances seem to be more predisposed to this complication than others.

Verhoeff, however, reported a study of several practically normal eyes, in which he removed the lens by the head-on method immediately after enucleation. Neither the ciliary body nor the retina was injured in any way.

St. Martin quotes 15·5 per cent. of iritis after 255 extra-capsular and 3·2 per cent. after 654 intra-capsular extractions.

Infection.—In the absence of complications, infection is probably less frequent and more benign in the intra-capsular operation.

St. Martin quotes 225 cases of extra-capsular extraction with 3·1 per cent. of infections, of which 42·8 per cent. were benign and 654 cases of intra-capsular extraction with 1·4 per cent. of infection, of which 55·6 per cent. were benign.

De Grosz quotes 0·45 per cent. of infection in 2,000 cases.

In my paper on Holland's Hospital at Shikarpur, I quoted 1·3 per cent. of infection in 836 cases done by Smith's intra-capsular method and 1·6 per cent. of infection in 433 cases of intra-capsular extraction. These high percentages are largely due to conditions in India and the impossibility of pre-operative bacteriological examination at Shikarpur.

Detachment of the Retina.—It is sometimes held that one of the greatest bugbears to the operation is in the increased risk of the occurrence of retinal detachment afterwards. There does not seem to be enough statistical evidence for any final conclusion.

Arruga, in 1933, reported on 1,030 extractions at von Hippel's Clinic, published by Baurmann, and found that it was the complication of vitreous loss rather than the actual technique which was the important factor:—In 931 extractions without vitreous loss, 17 detached retinae=1·6 per cent. In 99 extractions with vitreous loss, 10 detached retinae=10 per cent.

Gonin, in 1934, considered that vitreous loss was not necessarily

the cause, but that the movement of the vitreous forward to take up the position of the extracted lens, was an important factor.

In 1932, Arruga reported that in 204 cases of intra-capsular extraction, there were 4 detached retinae. In a second series, he found only 2 detached retinae. There was no vitreous loss in either of these two cases, but high myopia in each.

Knapp, in 1925, stated that detached retina was much rarer in intra-capsular than extra-capsular extraction. He quotes 6 cases of the complication out of 500 intra-capsular extractions. There was loss of vitreous in one only. The detachments occurred from 2 months to 2 years afterwards. There were vitreous opacities in all cases and he considers that this condition, possibly due to low-grade iridocyclitis, was responsible for the complication.

St. Martin reports 9 cases of detached retina, of which 7 followed intra-capsular extractions; 4 of these were cases of myopia, (2 of them high myopia) and three of these (of which 2 occurred in association with myopia) had vitreous prolapse. He remarks that it is not possible to draw any precise conclusions from these statistics. He thinks that the complication is not such as to render the intra-capsular method unfavourable.

C. Dee Shapland, in 1934, read a paper on " Retinal Detachment in Aphakia." Between 1930 and 1933 inclusive, he found that 651 cases of simple detachment of the retina were admitted to the Moorfields Eye Hospital and of these 50, or 7·7 per cent., were in aphakic subjects. The last 21 of these cases of aphakia came from 225 cases, *i.e.*, the percentage had risen to 9·3 per cent.

With regard to aetiology, he found that antecedent myopia (64 per cent.) and vitreous loss (18 per cent.) are the important factors. Trauma is of small significance, 3 examples (10·7 per cent.), only, having an element of indirect trauma. The five cases in the vitreous loss group only included one with high myopia and so the remaining 4 probably had a more or less normal vitreous. The mechanism of the detachment appeared to be incarceration of normal vitreous in the Graefe section, a slow contraction of this towards the scar in the process of cicatrisation and a resultant upward traction on the retina in the lower half of the globe by the adherent infero-peripheral portion of the vitreous body, which eventually occasions a retinal detachment in this situation. There were six cases of " idiopathic " detachment, *i.e.*, in which no obvious cause was found. These occurred, on the average, 6 years after the operation, while the average period was 1·8 years in the myopic group, thus showing that capsulotomy appears to precipitate retinal detachment in the latter group.

As regards prophylaxis, Shapland remarks that every effort should be made to lessen the incidence of vitreous loss, although loss of normal vitreous is probably of greater consequence than

the loss of fluid or degenerate vitreous. Further, capsulotomy should be avoided as far as possible where moderate or high myopia was present before operation. In no less than 5 cases (out of 18) of the myopic series, a capsulotomy appears to have been the determining factor in initiating a retinal detachment, the mechanism apparently being additional traction on an already degenerate retina by a vitreous prolapse into the anterior chamber and consequent acceleration in the production of the retinal tear. He notes that it would be interesting to learn of the incidence of this complication after intra-capsular extraction as, if these premises are correct, the incidence of retinal detachment should be relatively greater.

Safar considers the complication not more likely in uncomplicated intra-capsular extraction. In fact, he thinks that the incidence of detachment of the retina (which Shapland suggests is sometimes due to lack of gentleness in performing capsulotomy) is slightly commoner after extra-capsular than intra-capsular extraction. He thinks that a slight, especially if fluid, vitreous loss makes no difference.

Knapp, in 1936, reported 6 out of 500 intra-capsular cases. The aetiology included vitreous opacities following operation, iritis with vitreous disturbance, hyphaema and vitreous loss. He says that retinal detachment after capsulotomy may be due to too deep a capsulotomy producing bands in the vitreous which lead to detachment of the retina.

In 1933, King reported 3 cases of detached retina out of 848 intra-capsular extractions at Elschnig's Clinic. All had high myopia and one diabetes and iritis.

Appleman, in 1933, quoted 3 cases of detached retina out of 100 intra-capsular cases. Duthie reported one case of retinal detachment out of 100 intra-capsular cases.

Thus it seems probable that an uncomplicated intra-capsular extraction carries no special risk of detachment of the retina. The slightly increased occurrence of vitreous prolapse, however, in intra-capsular cases, probably makes the complication of retinal detachment more likely after intra-capsular extraction.

(3) Choice of Cases

Authorities differ widely as to which cases are suitable for the operation. I propose to discuss the question from the aspect of the type and age of patient, general disease, local disease and type of cataract.

Type of patient.—Knapp believes that the intra-capsular operation should be reserved for certain cases. The patient should be co-operative and should not be nervous or restless. Tostevin,

similarly, considers the operation contra-indicated in very old or deaf patients whose co-operation cannot be relied on. Wright says that one-eyed patients should have the extra-capsular operation. They have more to lose and are often more apprehensive and troublesome; these patients therefore, should be given the benefit of the more conservative procedure.

Age.—There is much disagreement as to the lower age-limit for the operation. The strength of the zonule lessens with increasing age and so the older the patient, the more likely is the zonule to rupture before the capsule. St. Martin remarks that it is round about the 60th year that the zonule ruptures with ease. He mentions that Barraquer found that at 25, the zonule resisted a traction of 30 grams, but at 60, a traction of 3 grams was sufficient to rupture it.

St. Martin holds that congenital and traumatic cataract below the age of 25 are not suitable. Elschnig states that although few cases under 25 are suitable, no attempt should be made at the intra-capsular method before that age. Holland considers the lower age-limit for Smith's intra-capsular method to be 36 years. Arruga, similarly, states that congenital cataract and cataract in young persons are unsuitable.

Tostevin considers the lower age-limit to be 35 years. He says that between 35 and 50 the operation is sometimes successful, but he advises that if a reasonable attempt to break the suspensory ligament does not succeed, the extra-capsular operation should be performed.

Safar believes that a cataract in a person under 45 is unlikely to be suitable. Urbanek says the same, but makes an exception for myopia and cataract following iridocyclitis (in patients younger than 45) when the intra-capsular method may be tried.

Fischer, of Vienna, considers that, as a general rule, 60 years should be the lower age-limit. Traquair, on the other hand, does not consider age a contra-indication. He has successfully extracted a traumatic cataract in a patient of 26 by this method.

Verhoeff, who employs the head-on method, always does intra-capsular extraction over the age of 50, and only below that age does he restrict it. Van Lint does not recommend the operation below the 60th year.

It is probable that 55 years should be the lower age-limit, with possibly exceptions in the case of low myopia and cataract following iridocyclitis.

As regards the upper age-limit, there are few recorded views.

A patient of advanced age, unsuitable from temperament, general or ocular disease, will, of course, contra-indicate the operation. The vitreous body tends to become more fluid as age

advances and there is, therefore, an added risk of vitreous prolapse. Further, the risk is increased in those cases where the zonule is excessively friable or even dehiscent in part and fluid vitreous may have found its way into the posterior chamber. Further, vascular disease is more common in the aged, with an increased risk of choroidal haemorrhage. Hagen, of Oslo, did not employ the intra-capsular method in patients above 80 for these reasons.

It is suggested therefore that the operation should not be performed when the patient is more than 80 years old.

General disease.—Any accompanying systemic disease renders the operation unsuitable by increasing the risk of complications: *e.g.*, cardio-vascular renal disease, raised blood-pressure, marked arteriosclerosis. Diabetes, which is controlled, is not a contra-indication and the lens matter after extra-capsular extraction may set up unpleasant iridocyclitis in the presence of diabetes. Wright mentions conditions giving rise to straining as unsuitable, *e.g.*, cough, asthma, enlarged prostate, piles, mental affections, cardiac failure, habitual sneezing, cystitis or vaginal discharge.

Sensitivity to lens protein.—Goodman, in an article on endophthalmitis phaco-anaphylactica, recommends intra-capsular extraction in all favourable cases when there is any reaction to the cutaneous test with lens protein. He investigated 700 unselected patients with cataract, in 1932, and tested their sensitivity to lens protein. Of these, 16·9 per cent. showed sensitivity, but only 5·4 per cent. had severe reactions. It was among patients of the latter group that the few cases of undoubted endophthalmitis phaco-anaphylactica were found.

However, it could not be definitely ascertained beforehand whether a post-operative ocular reaction was to be expected. It could only be suspected, as the following figures show. Only 53 patients showed excessive post-operative ocular reaction and, of these, 31 showed no cutaneous reactions and 22 showed cutaneous reactions of some degree. Nevertheless, of the 31, 4 showed severe post-operative ocular reactions while of the 22, 11 had post-operative ocular reactions of severe degree.

Goodman concludes that endophthalmitis phaco-anaphylactica needs to be feared only when the patient has shown a marked hypersensitivity to lens protein and, further, that such a reaction is rendered more likely if a moderate or large amount of lens matter is left in the anterior chamber. He doubts whether routine testing for hypersensitivity to lens protein will ever come into use, partly owing to the rarity of endophthalmitis phaco-anaphylactica. However, he recommends it and treatment by desensitisation in the following types of case:—

(1) When cataract extraction is contemplated and the same operation has been followed by a severe post-operative reaction in the other eye.

(2) When a posterior capsulotomy on the operated-on eye is contemplated and there has previously been a severe reaction in this eye.

The question as to how this affects the intra-capsular operation should be looked at in this way. Are the risks of the intra-capsular operation greater than those of endophthalmitis phaco-anaphylactica?

Doubtless the answer is in the affirmative although the latter disease is established as a rare complication of cataract extraction. There are definite risks attached to the intra-capsular operation. It is suggested therefore, that after a severe reaction following cataract extraction, desensitisation treatment should be undertaken before posterior capsulotomy on the same eye, or cataract extraction on the other eye, in preference to intra-capsular operation on the other eye.

Local disease.—(1) Myopia. In this condition, there are several factors calling for consideration. There is a greater risk of prolapse of vitreous, especially in the higher degrees of myopia. If vitreous prolapse should occur, there is a possibility of detachment of the retina, secondary glaucoma, organisation of the vitreous or drawn-up pupil.

St. Martin quotes 11 cases of expulsive haemorrhage, of which 4 occurred in high myopia.

Fischer believes that after the extra-capsular operation in myopia, there is an increased likelihood of proliferation of the lens capsule, needing a posterior capsulotomy afterwards and, this, according to Shapland, carries an increased risk of retinal detachment. In his series over the four years, 1930 to 1933, there were 28 cases of detachment of the retina following extra-capsular extraction, and, of these, 64 per cent. occurred in myopia, 8 in low myopia (0-5D.), 5 in intermediate (5-10D.) and 5 in high myopia (over 10D.). As a prophylactic measure, Shapland recommends the avoidance of posterior capsulotomy in medium or high myopia. In no less than 5 of the myopic cases, a capsulotomy seemed to be the determining factor, initiating the retinal detachment. Further, the zonule is weak in myopia, making intra-capsular extraction easier and enabling it to be done at an earlier age.

Safar condemns intra-capsular extration in myopia above 10D., but recommends it in less degrees of myopia to avoid a second capsulotomy. Urbanek does not consider high myopia a contra-indication, and favours intra-capsular extraction in low myopia

even in persons under 45. Fischer, who is more cautious than many authorities on the subject of indications for intra-capsular extraction, recommends the operation in low myopia. Knapp remarks that the intra-capsular operation is not indicated when there is vitreous disturbance, as in myopic eyes. Duthie, however, says that in a case of high myopia with nuclear cataract (V.=6/36 or less with correction) it is the method "par excellence."

There is little doubt that in myopia of more than 10D., the operation is not indicated. In lower degrees of myopia with no evidence of previous vitreous degeneration, the operation may be very cautiously attempted and at a rather younger age than 55, if necessary.

Exophthalmos.—Although some authorities hold that a prominent eye, whether or not in Graves' disease, is no contra-indication, it is probably wiser not to do intra-capsular extraction in such cases. Hartshorne, Tostevin, Knapp and Holland condemn the intra-capsular operation with this condition.

Glaucoma.—If the tension of the eye is within normal limits, a glaucomatous eye is no contra-indication to the operation.

Shallow anterior chamber.—Wright prefers capsulotomy in such a case, for it may be associated with incipient glaucoma and the incision is difficult to perform correctly.

CERTAIN TYPES OF CATARACT.

Complicated cataract.—The views of various authorities will be discussed. Elschnig considers that the triumph of the intra-capsular operation comes with these cases. "In all cyclitic cataracts, not only is intra-capsular extraction easier to practise, but also it is suitable for 100 per cent. of such cases; one is surprised at the excellent operative results in those cases where lens matter, following capsulotomy, would have provoked irido-cyclitis with possible occlusion of the pupil. If there are a few isolated posterior synechiae, the extraction should be done without iridectomy. If there are numerous posterior synechiae, an iridectomy should be performed, followed, after 4-6 weeks, by intra-capsular extraction. These adhesions may be ruptured after the corneal section, if no prolapse of vitreous occurs. If this occurs, extraction with the vectis or spoon is necessary. Intra-capsular extraction is impossible if the iris is completely adherent to the lens. This can only be recognised, after the iridectomy is done, by the mass of uveal pigment on the anterior lens capsule."

St. Martin supports Elschnig's views, and mentions that in two cases with almost complete synechiae present, he did a preliminary iridectomy and he was afterwards able, by careful movements of

the spatula, to free the lens of synechiae and then to extract it in its capsule with very satisfactory results.

Stock, at Amsterdam, in 1929, reported 52 intra-capsular cases in chronic iridocyclitis and considered that the intra-capsular is the only operation in which a favourable result can be anticipated.

Wright, after very considerable Indian experience, recommends the extra-capsular operation for such cases, and suggests that synechiae should not be dragged upon and the " status quo " disturbed as little as possible.

Marin-Amat does not practise intra-capsular extraction when the pupil does not dilate properly with atropine (tested previously) despite the absence of visible synechiae, since although such synechiae can be ruptured by the spatula, this operation is liable to lead to loss of vitreous. He says that sometimes there is an adhesion between the equator of the lens and the root of the iris and, when pressure is made by the forceps, the sphincter travels towards the periphery; finally, the iris becomes totally reversed and iridodialysis may occur.

Stallard, in a recent article, discusses the question and states that, after the extra-capsular extraction, the pupil is sometimes liable to occlusion from dense capsular remains and fibrous tissue, the contraction of which draws its margin to the centre, necessitating often a number of capsulotomies and iridotomies; severe cases ultimately require removal of a piece of iris and capsule to reconstruct an adequate pupillary aperture. He recommends, in cases where the iritis has not been severe and the intra-ocular pressure normal, a preliminary iridectomy, in order to determine the reaction of the eye to operation and to obtain an idea about the nature and position of the posterior synechiae. If the latter are limited to the pupillary region and not extensive and if the eye responds favourably to iridectomy, he prefers intra-capsular extraction by the head-on method. He breaks the posterior synechiae with a few gentle sweeps of the iris repositor; the capsule forceps are applied to the lens in the 12 o'clock meridian, just in front of the equator (the preliminary iridectomy renders the site for application readily exposed) the forceps are separated 3 mm., pressed gently into the capsule, and then closed.

Rotatory movements, clockwise and anti-clockwise, at first small excursions and then larger, are made in the plane of the equator. When the upper pole of the lens is felt to come forward, the lens is lifted forwards and upwards, the lateral movements are continued over a little wider excursion and, simultaneously, a crochet is placed over the lower part of the cornea below the lower pole of the lens. From this moment, the capsule is not pulled upon by the forceps, but delivery is mainly effected by moving

the crochet upwards over the cornea in a zig-zag manner below the lower pole of the lens until it is safely delivered from the wound.

Urbanek recommends the trial of intra-capsular extraction in cases of cataract following iridocyclitis, even in patients below 45. He says that although vitreous loss is likely, the loss of such fluid and degenerate vitreous is not serious, as the vitreous which forms in its place tends to be free of opacities. Many would regard this attitude as dangerous.

Knapp does not recommend the operation in a case where there has been vitreous disturbance, *i.e.*, a " cyclitic " eye.

Sinclair quotes good results in 10 cases of old iritis and cyclitis in which vision was 6/12 or better and states that intra-capsular extraction is remarkably successful in cases of this type.

Having regard to these conflicting views, intra-capsular extraction may be very cautiously attempted in those cases where limited adhesions can be broken down easily and the extra-capsular operation should be reserved for cases with many synechiae which cannot be easily ruptured.

Hypermature cataract.—This term includes a number of varieties of cataract. The zonule is often weak, the capsule friable and sometimes difficult to grasp, owing to liquefaction of part of its contents and the majority of authorities regard this condition as a contra-indication to the operation.

Wright, in cases of thickened capsule plaque or irregularly thickened capsule in hypermature cataract, recommends gentle feeling with the Kalt forceps. Should the capsule come away with the gentlest movement without disturbing the zonule, the case is treated as extra-capsular. Should it hold well and very little hold is required in these cases owing to the weak zonule, it is dealt with as intra-capsular.

As regards a collapsed Morgagnian cataract with the nucleus lying in an empty bag, capsulotomy is performed and if possible, the capsule removed with forceps afterwards. Elschnig, similarly, regards Morgagnian cataract as a contra-indication but recommends the operation in hypermature cataract with a large brown nucleus and in cataracta brunescens.

Kubik, however, regards the operation as contra-indicated in cases of hypermature cataract with a large nucleus and in Morgagnian cataract. Blascovics recommended extra-capsular extraction for brunescent and fluidified senile cataract. Arruga regards the operation as contra-indicated in cases of over-ripe cataract. St. Martin remarks that hypermature cataract and shrunken cataract are less suitable for intra-capsular extraction than others (mentioned below).

It is thus evident that the majority of operators do not regard the condition as suitable for the intra-capsular operation.

Intumescent cataract.—All authorities appear to be agreed that, in this condition, intra-capsular extraction is not indicated. The lens is swollen, the anterior chamber shallow, making an adequate incision difficult, and the capsule tense, making the grasp of it with the forceps difficult. Elschnig, Kubik, Arruga, Safar, Urbanek and de Grosz are all in agreement on this point.

Traumatic cataract and dislocated cataract.—In these conditions, it is possible that the hyaloid membrane and zonule are weak or have ruptured and, if so, vitreous prolapse is likely. de Grosz, Arruga, Holland (in his list of contra-indications for Smith's method) and Hartshorne condemn the intra-capsular operation for use in these conditions. Duthie, however, mentions 2 cases of congenital dislocation of the lens, both of whom obtained normal vision after using the intra-capsular method.

Immature cataract.—All authorities are agreed that this is the most suitable type of cataract for the intra-capsular method. Elschnig, St. Martin, Kubik, Sinclair and many others have testified to this. Parker and Gradle, in a series in which they concluded that, on the whole, the extra-capsular operation was preferable to extraction in the capsule, stated that the former was unsuitable for immature cataracts, for which they preferred intra-capsular extraction.

A number of series of results have been published showing that the risk of ruptured capsule is higher in immature cataract than mature; *e.g.*, Kadlicky quotes 30 per cent. compared with 10 per cent., St. Martin's figures are 41 per cent. and 35 per cent. Elschnig had 8 ruptured capsules out of 21 immature cataracts= 39 per cent. (of which 5 were extracted separately) and 9 ruptured capsules out of 40 mature cataracts=22 per cent. (of which 4 were extracted separately). But in these results, no mention is made of the patient's age, and if these had been limited to cases above, say, 55, it is probable that the incidence of ruptured capsule would have been no greater than in mature cataract.

Castroviejo stated that the chances of success decreased in this order: (1) soft cataract; (2) incomplete nuclear and complicated cataract; (3) total nuclear cataract.

Greenwood and Grossman have published the results of 1,343 cataract extractions, and find that ruptured capsule is less likely (9·6 per cent.) in immature cataracts than in mature cataracts (20 per cent.) and vitreous loss also less likely, 2·8 per cent. as opposed to 8·4 per cent.

Immature cataract may be regarded as one of the suitable kinds of cataract for the intra-capsular operation.

Mature cataract.—There is little doubt that a mature cataract is a suitable condition for intra-capsular extraction. However, such good results may be obtained by the classical method, with such refinements in technique as capsulectomy and irrigation of the anterior chamber, that it is a debatable question whether intra-capsular extraction is indicated. However, a definite proportion needs posterior capsulotomy afterwards (Stallard quotes 7 per cent. of his cases), and this carries a very slight but definite risk of complications, such as retinal detachment and secondary glaucoma.

Elschnig, St. Martin, de Grosz and others, mention the condition as being especially suitable for intra-capsular work. The capsule is usually easier to grasp than in immature cataract.

Safar recommends extra-capsular extraction in mature senile cataract. He has excellent results with capsulectomy and often no posterior capsulotomy is necessary afterwards.

Summary.—Cases should be very carefully selected, with particular attention to the type and age of patient, absence of general and local disease and to the type of cataract. While there is no general agreement as to the contra-indications for the operation, the most suitable patients are those with immature senile cataract, who can co-operate well, who have no general or other ocular disease and in whom the age lies between 55 and 80.

(4) Important Details of Technique

Mydriasis.—Pre-operative sedatives and facial nerve block (in preference to lid anaesthesia) are all-important and will not be discussed. Traquair prefers anaesthesia of the skin of the lids. The patient cannot feel anything and thus has no tendency to squeeze. However, a facial nerve block and retro-bulbar anaesthesia will obviate the tendency to squeeze.

One of the most important details in intra-capsular work is satisfactory mydriasis. There are various methods of achieving mydriasis. Traquair injects 1·5 per cent. novocain with adrenalin subconjunctivally at 6 o'clock and 12 o'clock. De Grosz, who employs complete iridectomy uses cocaine and adrenalin for mydriasis. McCool and Dickey use 3 per cent. suprarenin bitartrate on a small cotton pledget 5 minutes before the incision, applied to the limbus from 4 to 8 o'clock. They prefer this to subconjunctival injection, as this balloons the conjunctiva. Peter recommends Barraquer's method of 5 per cent. euphthalmine and cocaine ointment half-hourly, several times before operation.

Stallard's method is satisfactory; this consists of 5 or 6 applications of 1 per cent. homatropine at 15-minute intervals before

operation; this is augmented by subconjunctival injection of 2 or 3 minims of adrenalin chloride 1:1,000 at 6 o'clock, 2 mm. from the limbus 45 minutes before operation.

Anaesthesia of conjunctiva.—Various concentrations of cocaine, with or without adrenalin, are popular, *e.g.*, cocaine 4 per cent., with adrenalin 1:3,000 6 instillations of 2 drops at two-minute intervals, with one drop in the other eye. Traquair recommends 4 per cent. or 5 per cent. cocaine with adrenalin. He has tried holocain and decicain but finds they cause more irritation than cocaine and adrenalin and appear to offer no advantages.

Stallard, however, prefers 4-6 drops of 1 per cent. decicain (pantocain) with 2 drops of 1:1,000 adrenalin. He prefers decicain as it does not damage the corneal epithelium nor cause any toxic effects such as coffee-ground vomiting after operation, as cocaine sometimes does. He has, so far, not seen any toxic manifestations after its use in several hundred cases. It acts more quickly than cocaine, and he thinks it also has an advantage in that patients do not feel the weight of instruments touching the eye as happens with other local anaesthetics. It does not raise the intra-ocular pressure, and the only slight disadvantage is the slight hyperaemia it induces after instillation in some persons and its failure to check capillary oozing as cocaine does, but these defects are readily overcome by instilling adrenalin drops after the decicain.

Retro-bulbar anaesthesia.—Retro-bulbar anaesthesia is of great value in intra-capsular work. The anaesthesia has the following advantages. Pain and therefore movements caused by pain, are abolished, squeezing from contraction of the extra-ocular muscles tends to be abolished; the intra-ocular pressure is reduced, lessening the risk of vitreous loss; in the event of vitreous prolapse, it is smaller, appears more slowly and is more easily controlled; it postpones the reappearance of post-operative pain.

However, there are a number of disadvantages. There is more time taken; there is a slight risk of retro-bulbar haemorrhage, causing alarming proptosis and necessitating postponement of the operation; the softening of the eye may be so marked that the capsule is difficult to grasp with the forceps; if the extra-ocular muscles are paralysed, the patient cannot fix properly; the adrenalin in the injection fluid sometimes causes complete temporary amaurosis from contraction of retinal blood-vessels; there is an increased risk of bleeding from the conjunctival flap.

McCool and Dickey say: " 25 years' experience in ophthalmic surgery has shown that 90 per cent. of the complications which arise during operations are due to pain and that, if this be

eliminated, there is a much greater chance of completing the operation satisfactorily. If we were obliged to discard all the measures which we use to safeguard the eye, save one, we would unhesitatingly retain retro-bulbar injection. It not only makes the iridotomy or iridectomy absolutely painless, but prevents any involuntary movement of the patient should the iris be cut as the incision is completed. Furthermore, there is no evidence of pain when the lens is passing through the pupil. At this critical stage of the operation, it is imperative that the operator shall have complete control of the situation, which he most certainly cannot have if the operation is painful."

Some authorities, including Blascovics, Elschnig, de Grosz, Urbanek and Gifford prefer the anaesthetic solution to be injected retro-bulbarly. Others, *e.g.*, Safar, prefer it to be para-bulbar, temporally and below. Arruga strongly recommends retro-bulbar injection. Stallard prefers an injection of novutox into Tenon's capsule. He finds it effective in preventing pain from touching the iris or other intra-ocular manoeuvres, and believes it to be safer than a retro-ocular injection, which risks an orbital haemorrhage and lowers the tension immediately. Indeed, Knapp does not regard the softening effect as being necessary.

Neither Hartshorne nor Rotth of Budapest employ the injection because of the risk of orbital haemorrhage. Anthony follows Verhoeff's advice of the injection subconjunctivally of 2 per cent. cocaine at the limbus. Gifford remarks that subconjunctival injection of 2 minims of 4 per cent. cocaine at the sites of fixation and incision, followed by a wait of 4 minutes, will give perfect anaesthesia; however, he believes retro-ocular injection to be advisable in intra-capsular work and has always considered this to be one of the reasons why Elschnig so seldom lost vitreous.

Traquair, in cases of insufficient dilatation of the pupil, employs an injection of 0·5 c.c. novocain, immediately behind the eyeball, with a special needle. He employs 1·5 per cent. novocain with 0·4 per cent. potassium sulphate and 1·5 per cent. of 1:1,000 adrenalin. He says he has seen cases in which the recti muscles were paralysed by the ordinary injection, rendering the patient unable to move the eye in the correct direction.

There is little doubt that retro-bulbar anaesthesia of some kind is very important. By using a Tenon's capsule or parabulbar injection, pain is abolished and the intra-ocular tension slightly reduced. By employing retro-ocular anaesthesia, these objects are also attained, with greater lowering of the intra-ocular tension. However, there is a slight but definite risk of retro-ocular haemorrhage.

Anaesthetic solution.—Various concentrations of novocain and

adrenalin are commonly used, *e.g.*, 2 per cent. with 2 minims of 1 : 1,000 adrenalin. McCool and Dickey employ 2 c.c. of 4 per cent. novocain with 2 minims 1 : 1,1,000 adrenalin. Elschnig uses 1 c.c. of 2 per cent. decicain with epinephrin. Stallard injects 1·0 c.c. of 2 per cent. novutox with 0·0025 per cent. adrenalin into Tenon's capsule. Mayer strongly recommends using not more than 0·8 c.c. of 2 per cent. novocain and adrenalin. He had 4 disastrous cases in which more than this was used and expulsive haemorrhage followed 2 hours after operation, followed by the loss of the eyes. Safar uses a German preparation, corbasil. This avoids a rise in blood-pressure, arterial constriction or temporary amaurosis.

Technique of injection.—If the retro-ocular injection is employed, a needle smeared with liquid paraffin (Duthie recommends size 22 of Messrs. Down) 4 cm. long is pushed through the skin upwards, inwards and backwards, at the lower and outer angle of the orbit, 1 cm. medial to the external canthus. The plunger should be withdrawn before injecting the fluid to make sure the solution is not in a vein. There is a softening effect beginning within one minute and reaching its maximum in 3 or 4 minutes. Therefore, a short time should elapse to allow the softening to occur.

Duthie recommends that 20 minutes should elapse before the corneal section is made and remarks that it does not make the section any more difficult and helps to prevent the vitreous from dislocating forwards. He compares the results of 58 cases in which the lens was removed immediately after injection and 42 cases after allowing time for the globe to soften. He has no hesitation in saying that preliminary reduction in tension is much safer.

Elschnig compresses the eye 3 or 4 minutes after injection through the lower lid before making the incision. Stallard recommends waiting 7 minutes for the Tenon's capsule injection to work.

The author recommends a retro-bulbar injection of not more than 1·5 c.c. of 2 per cent. novocain or 2 per cent. novutox with 2 minims of 1 : 1,000 adrenalin.

Corneo-scleral suture.—Few operators who use the intracapsular method, will question the value of some kind of suture for securing the corneo-scleral wound firmly. Various authorities favour different methods for achieving this. Barraquer, Elschnig, Arruga, Sinclair and others employ one or more sutures in the conjunctival edge of the corneal flap; others, including van Lint, Liebermann, H. Vanderbilt, Würdemann, Rohmer, Federici and Blascovics prefer a conjunctival curtain to cover the incision and the upper part of the cornea.

Other measures include a conjunctival bridge, nasally and temporally, a corneo-scleral suture, a conjunctival flap or combinations of these. A suture of some kind gives an element of security to the operation which cannot be gained in any other way. The corneo-scleral suture is to be recommended.

Advantages of suture.—(1) Control of the wound. This is readily achieved; the immediate tightening of the suture is the only procedure which will check a relentless flow forward of vitreous, conjunctival sutures being quite useless when this disaster occurs. In cases where the vitreous appears likely to prolapse, it allows the operator to keep the wound open as widely or as little as possible in order to complete the operation.

Sinclair uses a wound guard in threatened or actual prolapse of vitreous, which closes the wound while the conjunctival suture is being tied.

(2) It favours immediate and firm coaptation of the wound as soon as the suture is tied.

(3) It favours quick re-establishment of the anterior chamber and the liability to iris prolapse is very considerably lessened (Stallard). Further, the rare and serious complication of reversed corneal flap is made impossible.

Verhoeff employs 2 corneo-scleral conjunctival sutures, one on either side of the mid-line and is said never to have had iris prolapse, or lost an eye from infection, with these.

(4) It protects the wound after operation. This is especially important with elderly patients who should move about and get up early. Peter refers to the fact that the literature is full of strange and bizarre events through which patients have passed during convalescence, without damage, only by reason of corneal sutures. These include falling out of bed, knocking their eyes, becoming delirious, vomiting and so on. He says that the mental ease which the suture gives to the operator is by no means a negligible factor.

(5) The risk of post-operative hyphaema is very considerably lessened. Stallard, in a series of 107 consecutive cases of cataract extraction (of which 28 were intra-capsular) did not have this complication occur once. No untoward consequences have occurred in the series of 107 cases in which this stitch has been used. On this account alone the insertion of a corneo-scleral suture is worth while.

(6) Aid to fixation. Basil Graves maintains that the scleral part of the stitch may be held in plain forceps and so used for fixation of the globe in old persons in whom the conjunctiva is very thin and liable to tear with fixation forceps.

(7) Aid to introduction of capsule forceps. The corneal part of

the stitch may be held in plain forceps, and used to lift the corneal edge of the section wound forwards, and so facilitate the introduction of capsule forceps.

(8) Post-operative astigmatism tends to be reduced. Stallard mentions that in some cases there was no astigmatism, and the average has been between 1·5D. and 2·25D. axis 0 to 30.

Disadvantages of suture.—It cannot be denied that the insertion of a suture of some kind lengthens the time of the operation and adds to the manipulations to the eye. Brodrick believes that, in spite of the known advantages, the average operator in the intracapsular operation incurs a greater risk from trauma and repeated attempts than by the omission of the suture. Further, it tends to cause a contraction of the pupil, according to Urbanek.

With regard to increased infection of the eye which it is sometimes alleged to cause, St. Martin states that, in cases of infection, it is exceptional to find the start of the infection in the neighbourhood of the corneal or conjunctival sutures. He has only observed 3 infections at the suture in 1,000 operations. In such cases, he recommends immediate removal of the suture and use of the cautery. He further states that he has never known infection to start in the neighbourhood of a conjunctival suture. It is probable that the suture, in promoting the quick and firm co-aptation of the wound, tends considerably to diminish the risk of infection of the wound. Verhoeff remarks that the sutures never become purulent probably because of the continual flow of tears over them.

Stallard mentions the only complication due to the suture that he has ever seen. This is a mild degree of striate keratitis, localised in the upper part of the cornea. This generally clears up in 8-10 days and leaves no ill-effect. It is not so severe as the striate keratitis which sometimes occurs after cataract extraction, when a corneo-scleral suture has not been used. He has had no case of corneal abscess or ulceration arising from the use of this suture.

Stallard uses an eyeless " Mersuture " corneo-scleral needle with 000 silk, held in a modified Quarry Silcock's needle holder. He recommends a pair of operating spectacles for its insertion. The medial rectus muscle for the left eye, or the lateral rectus muscle for the right eye, is grasped with forceps for fixation. The needle is then passed transversely through half the thickness of the substantia propria, 1 mm. inside the limbus for 2 mm., then through the conjunctiva and episcleral tissue and half the thickness of the sclera 1·5 mm. behind the limbus, at 12 o'clock.

Half of a surgeon's knot is made with the ends which are then placed clear of the site of the corneal section. A green gauze face mask coming close to the lid margins prevents the suture from making contact with the skin of the cheek.

Speculum.—A self-retaining speculum which does not press upon the eyeball is essential. Arruga's speculum is so constructed that the weight of the retractor is borne on the bridge of the nose and the skin in the temporal region. Stallard uses this retractor, made with a dull black finish, so that light reflexes from its edges are eliminated.

Duthie prefers, in place of retractors, strong silk sutures in the skin of the upper eye-lid, one at the middle and outer third and the other at the middle and inner third, with a similar suture in the middle of the lower lid, all held with Spencer Wells' forceps.

Blascovics' speculum with a stop screw on the sliding arm, is similar to Arruga's and very satisfactory and the same speculum can be used in either eye. This type is recommended.

Superior rectus suture.—Some patients find it difficult to maintain self-control on the table. These cannot always be picked out beforehand, so it is wiser to leave nothing to chance, and take precautions so that the operator may have complete control over the eye. Further, tension on a superior rectus muscle, makes it unnecessary for the patient to look down voluntarily; hence he need not be spoken to nor have the fear that he is not co-operating well.

Either the belly of the superior rectus muscle may be injected with 1 cc. of novocain, or a No. 1 silk suture may be passed through the tendon. Some prefer to tie this suture to a small projection on the upper shank, others like to leave it held by an assistant.

This stitch is not altogether free from inflicting damage, for if the patient looks down too far, the sclera is dragged upon, the wound opens widely and vitreous may escape. This is more likely to happen if the stitch is tied to the shank of the speculum, for it cannot be slackened, as is the case when an assistant holds it.

There is an objection to the injection of novocain into the belly of the superior rectus muscle in that it may cause ballooning of the conjunctiva and thus interfere with the placing of the corneo-scleral suture.

If the suture is preferred, it should be gently held, and if the patient does not co-operate satisfactorily, not unduly drawn on, but maintained with sufficient tension to preserve the desired position of the eye. Especially is to be avoided undue tension after delivery of the lens, as this may cause vitreous prolapse.

In most cases, the upper part of the corneo-scleral suture may be used, thus dispensing with the superior rectus suture, but if the patient shows himself unable to look down, either by temperament or from paralysis caused by the retro-bulbar injection, a superior rectus suture should be inserted at once.

Fixation of red lamp.—The use of this is to be recommended, for it secures all requirements of eye position, has a markedly steadying effect upon the patient and is free from the dangers due to mechanical fixation after the incision has been made. However, after a retro-ocular injection, the patient may not be able to move his eye.

Incision.—The incision should be larger than usual and extend just above the horizontal diameter of the cornea at the limbus and finish with a narrow edge of conjunctiva. The incision should be made swiftly until it has neared its completion. This makes the best incision and prevents the iris coming forward and being cut.

Duthie states that provided the globe is softened, the section is best made completely with the Graefe knife and not enlarged by scissors, but where the globe is not softened, there is danger of dislocating the lens if a large section is made with the knife. If, immediately after the incision, there is a pushing of the contents of the eyeball forward, with wrinkling of the cornea and imminent iris prolapse, this is a warning signal that vitreous prolapse is very likely to occur and the intra-capsular operation should at once be abandoned.

The corneal flap being more mobile, because it is larger, is apt to give rise to small haemorrhages from the wound, causing hyphaema. Hence the advantage of a stitch to secure apposition. St. Martin recommends the instillation of adrenalin immediately after the incision to limit haemorrhage.

Iridectomy.—The question of iridectomy has been much discussed in the literature, and authorities are by no means agreed as to which type of iridectomy should be performed, or none at all. With intra-capsular extraction without tumbling, it is almost essential to perform a complete iridectomy in order to grip the upper border of the lens correctly.

However, recently in America a pair of forceps has been devised with a heel for raising the pupillary border of the iris which obviates the necessity for iridectomy.

With the tumbling method, most authorities are agreed that the ideal to be aimed at is the round pupil. Besides its cosmetic and optical advantages, it helps to prevent a forward movement of vitreous and, in the event of ruptured capsule, there is less likelihood of the capsule becoming caught in the wound.

Blascovics, Safar, Sinclair and others prefer the round pupil but recommend complete iridectomy in certain circumstances. de Grosz wrote that there is no doubt that those who operate with a round pupil, display, in delivering the lens, the courage of a "salto mortale." He used to employ this method, but concluded

that neither Hess' peripheral iridectomy nor Elschnig's basal iridotomy, eliminated prolapse of iris, nor did it prevent post-operative displacement of the pupil. He agreed that intra-capsular extraction with the round pupil appears to be an ideal method.

With intra-capsular extraction, it is of the greatest importance that the pupil should be satisfactorily dilated. It is probable that the pupil should be at least 7 mm. in diameter before intra-capsular extraction can be performed without complete iridectomy. Complete iridectomy should be done before, but peripheral iridectomy after, the extraction. These rules apply especially to older patients in whom the lens is larger and the pupil less yielding. St. Martin advises peripheral iridectomy before lens extraction. The objection to this is that it tends to contract the pupil.

To secure the best position for peripheral iridectomy, it is necessary to ascertain that the iris is in position. It is apt to lie with the middle part of its anterior surface towards the wound so that iridectomy forceps, when introduced, do not with certainty grasp the periphery of the iris, but are liable to take hold of the part near the centre. A little corneal massage will usually suffice to promote the desired contraction and flattening of the iris and render the periphery accessible to the forceps. If the iridectomy is placed at the middle of the iris instead of peripherally, it is not situated in the best position to allow free flow of aqueous.

Wright notes that poor dilatation is common in the Orient and it is the exception rather than the rule for the pupil to dilate more than half with the best efforts at mydriasis. Rigid pupils which are more common in the deeply pigmented eye, are sometimes associated with adhesions to the iris pigment layer and, not infrequently, these previously unsuspected adhesions to the lens capsule are discovered at the time of the operation. An attempt at intra-capsular extraction in such a case may result in disaster.

If dilatation is poor, the operation may be started with an open mind and when the section is completed, the actual condition of affairs is determined by stroking the cornea or by gentle exploration with an iris repositor. If there is a peripheral synechia, it will decide the operator to perform extra-capsular extraction. With a badly dilated pupil, intra-capsular extraction may be done if the synechia is easily freed with a Ziegler's knife or iris repositor; the sphincter may be cut below or a marginal iridectomy performed. On the whole, with small rigid pupils, Wright prefers extra-capsular extraction.

As to whether Hess' peripheral iridectomy, Elschnig's basal iridotomy or a radial iridotomy is preferable, opinions differ. Peter states that Safar had 20 per cent. of iris prolapse with the

basal iridotomy and, on changing to buttonhole iridectomy, the incidence of this complication went down almost to zero. Traquair favours basal iridotomy for he says that there is slightly less risk of prolapse of iris with this than with peripheral iridectomy. Speaking at the Oxford Ophthalmological Congress last year, he stated that complications from iris prolapse and incarceration were the commonest of all those connected with the operation, and he has lately been using radial iridotomy.

Kalt prefers partial iridectomy with his special pointed hook. Duthie prefers peripheral iridectomy, combined with a satisfactory method of closing the wound firmly at once.

As mentioned above, complete iridectomy may be advisable (at a preliminary operation) in cases of cyclitic cataract. Complete iridectomy may also be necessary for satisfactory replacement of the iris in any case where vitreous is lost. The iridectomy should be as narrow as possible.

If hyphaema occurs, it should be irrigated away before the capsule forceps are introduced. If it is found impossible to irrigate away an attempt may be made to remove a large clot with forceps. If this is unsuccessful, it is advisable to abandon the intra-capsular operation.

St. Martin strongly recommends complete iridectomy if at the end of the operation the pupil is oval, as gradual ascension of the pupil is very likely. St. Martin quotes a statistic of Elschnig in 1932, which shows that iris prolapse is commoner after intra-capsular extraction (6·5 per cent. with the forceps method, compared with 2·2 per cent. with extra-capsular extraction). However, these figures are of cases where a corneo-scleral suture has not been used.

In general, Hess' peripheral iridectomy after the extraction of the cataract is recommended unless the pupil is smaller than 7 mm. in diameter, when a narrow complete iridectomy should be made before the extraction.

Forceps.—It is important that the forceps should be so made that the blades are in exact apposition to each other, that the grip is of equal strength all along the blades and that they have no roughness which might cause tearing of the capsule.

Safar always tests his forceps before operation by lightly picking up a portion of rubber glove and pulling.

There are a number of different types, *viz.*, that of Arruga, Blascovics, Basterra, Castresana, Duthie, Elschnig, Kalt, Lagrange, Sinclair, Stanculeanu and Verhoeff.

The author prefers Arruga's forceps.

Introduction and grasp of forceps.—This description is derived from the technique of Arruga, Elschnig, Knapp, Sinclair, Stanculeanu, Török and others.

This manœuvre should be done with the greatest gentleness. The corneal flap should be slightly raised by drawing on the silk suture in the cornea. The forceps should be introduced closed and care should be taken not to traumatise Descemet's membrane or the anterior lens capsule. A friable lens capsule will rupture if knocked as the forceps are introduced. The passage of the blades of the closed forceps continues until they reach the inferior border of the lens behind the iris. As the forceps are moved down, the handle should be raised so as to allow for the blades following the convexity of the lens. Misdirection of the forceps during the introduction may cause dislocation of the lens. This is especially liable to happen in a case of subluxation, which has not been previously recognised, or where the suspensory ligament is unusually weak and vitreous prolapse is likely to occur. They are then opened 2·5 mm. If opened less than 2 mm. too small a portion of capsule will be grasped and if opened more than 4 mm., it will be too large, and in either case there is likelihood of rupturing the capsule. As the blades approximate to grip the lens, the light pressure backwards is progressively increased, so that the margins of the blades as they meet indent the soft subcapsular cortex of the lens, care being taken not to grip the iris at the same time. It is important that the blades are held exactly parallel to the surface of the lens, as otherwise they will not hold the lens capsule along their whole length. If the eye has become softened owing to retro-bulbar injection, the lens may yield to the pressure of the forceps and cannot be grasped. This difficulty may be overcome by applying pressure to the sclerotic, just below the limbus, sufficient to hold the lens forward while it is grasped. It is important always to use the same kind of forceps, for the gripping force necessary with those of Arruga would immediately cause a ruptured capsule with those of Kalt.

After grasping the capsule with reasonable pressure in a backward direction, dislocation of the lens is commenced. It is important not to grip too tightly, as this may cause the capsule to rupture. Counter pressure with the heel of a strabismus hook or Arruga's cataract expression hook is applied to the sclerotic, 2 to 3 mm. below the limbus at 6 o'clock. This pressure should be the minimum necessary, for too vigorous pressure at this stage may cause the capsule to rupture or vitreous to prolapse. At the same time, very small lateral movements with slight traction are made with the forceps, the fingers appearing to vibrate slowly, to start the rupture of the suspensory ligament. These movements are gradually increased from 4 o'clock to 8 o'clock, the forceps being rotated round their own axis to avoid excessive tension on the capsule where they grip. According to

Goulesque, the zonular fibres are shorter and less resistant on the nasal side, and should be ruptured first. The simultaneous pressure without, and traction within, is gently continued and the lens watched. This part of the operation should on no account be hurried and it usually takes between 10 and 30 seconds or even as long as 70 seconds before the lens starts to tumble. It is sometimes necessary to press the point of the strabismus hook or Arruga's hook against the sclera at one spot where there seems to be some obstruction, while the forceps pull in the opposite direction, to assist in rupturing the zonule.

The start of the tumbling of the lens is recognised by:—(1) The latitude of the movements being noticeably increased; (2) A sensation of rupture in the suspensory ligament; (3) A movement of the inferior pupillary border. If there is dimpling of the sclera beyond the limbus, it is obvious that the zonule has not ruptured. If, after a reasonable time, the lens has not started to tumble, it is probable that the suspensory ligament is too strong and further attempts are likely to cause trauma to the ciliary body. The intra-capsular operation should therefore be abandoned. Knapp quotes 5 cases of severe iridocyclitis, which he considers due to neglect of this advice.

Directly the lens starts to tumble, pressure from below should be increased and traction from above decreased. The position of external pressure should be changed at once from the margin of the sclerotic to the lower edge of the cornea. This brings the pressure to bear through the cornea more directly upon the posterior aspect of the lower edge of the lens and less upon the vitreous generally. If the lens does not appear to have a tendency to tumble, as happens sometimes with a large nucleus in elderly people, it should be humoured and encouraged to deliver itself in the way it tends to go. Though traction from above is decreased, it is still continued with zig-zag movements upwards. These movements do not increase the risk of ruptured capsule, provided there is no obstruction to delivery of the lens by a rigid iris, too small an incision, or too small a cornea. When the lens has half tumbled, no further traction should be made, but the forceps should still grip the capsule at this stage. If the forceps exert any pull, a ruptured capsule is likely to occur. After the lens has moulded and is about to be delivered, it should be restrained from anything like a sudden completion of its exit. This helps to avoid the risk of vitreous loss. The last third of the lens should therefore be held in the wound for a few seconds. Delivery of the lens is slowly achieved by the heel of the strabismus hook pressing through the cornea, passing slowly upwards. This pressure must not be lessened for, if the capsule should rupture, the lens may slip back on the vitreous face. The

assistant should hold the corneo-scleral suture ready to tighten during the tumbling procedure, as prolapse of vitreous sometimes occurs suddenly at this stage.

When the lens is delivered, the corneo-scleral suture is tightened, while peripheral iridectomy and iris toilet is performed. It is very important indeed that the tip of the iris repositor should not reach the pupillary margin, as this is very likely to rupture the hyaloid membrane.

If the capsule has ruptured during delivery of the lens, a short irrigation of the anterior chamber should be attempted and a gentle attempt made to remove capsular remnants after the corneo-scleral suture has been tightened. The iris being in place, contraction of the pupil may be achieved by gentle massage through the cornea. The corneo-scleral suture is tied after the operator has made certain that the conjunctival edge of the corneal flap does not turn inwards, but lies flat. Two per cent. pilocarpine or 1 per cent. eserine drops (Elschnig uses 1 per cent. physostigmine with 1:5,000 mercuric oxycyanide ointment) are inserted, with a drop of 10 per cent. protargol; if complete iridectomy has been done, a drop of 1 per cent. atropine is inserted instead of the miotic. The stitch in the upper lid is then fixed to the cheek and a double pad placed over the eyes with a shield fixed over the operated eye with plaster. A linen dressing with tapes around the head, as used at Moorfields Eye Hospital, keeps the pad in position.

Post-operative treatment.—Both eyes are bandaged for 48 hours. After 24 hours, a drop of 1 per cent. atropine is instilled into the operated eye. If miotics are continued, there is danger of iritis developing.

The operated eye is dressed and 1 per cent. atropine instilled daily until the eye is white. Neglect to use a mydriatic may give rise to secondary glaucoma, owing to adhesions of the iris to the anterior vitreous surface. The shield should be worn for 1 week by day and 3 weeks by night.

Stallard recommends removal of the corneo-scleral stitch under 1 per cent. decicain anaesthesia on the fourteenth day, care being taken to pull in the line of the stitch after cutting it. The upper lid is raised by Desmarre's retractor and the stitch held in straight iris forceps and cut with ground-down de Wecker's scissors.

Dark glasses should be given on the eighth day and spectacles at the end of six weeks.

Elschnig has written that no operator is justified in attempting the intra-capsular operation until he has mastered extraction with capsulotomy. It is advisable, before attempting an intra-capsular extraction for the first time, for the operator to perfect his skill

in performing each step of the technique correctly with the extra-capsular operation, *e.g.*, Tenon's capsule or retrobulbar injection, corneo-scleral suture and grasp of capsule with forceps. Further, the intra-capsular operation should be abandoned at any moment if conditions do not seem to be suitable.

De Grosz recently wrote that the words of the great ophthalmic surgeon, Arlt, should be borne in mind when faced with the problem of the operation: "Salus aegroti suprema lex" (the welfare of the patient is the supreme law).

The author of this article prefers the classical operation, employing corneo-scleral suture, capsulectomy with Vogt's capsule forceps, anterior chamber irrigation, and peripheral iridectomy. The results of this method are so satisfactory that he would not recommend the more risky intra-capsular operation.

(5) Summary and Conclusions

(1) The advantages and disadvantages of the intra-capsular extraction of cataract with forceps are discussed.

(2) The incidence of certain complications of the operation is investigated.

(3) The importance of a careful selection of cases and attention to minute details of technique is emphasised.

(4) Not until further statistics are published, showing the end-results of selected cases compared with the end-results of the classical operation, can any conclusions be arrived at as to whether the use of the intra-capsular operation is justified.

(5) While possessing certain advantages, the intra-capsular operation carries with it an increased risk of certain complications.

(6) The results of the classical operation are so satisfactory that it is doubtful whether it will be superceded by the intra-capsular operation even in selected cases.

(7) It is probable that under poor conditions where increased risks have to be taken, *e.g.*, in India, the intra-capsular operation in selected cases is preferable.

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ANALYSIS OF THE JUDGMENT OF RELATIVE POSITION

(Preliminary Communication)

BY

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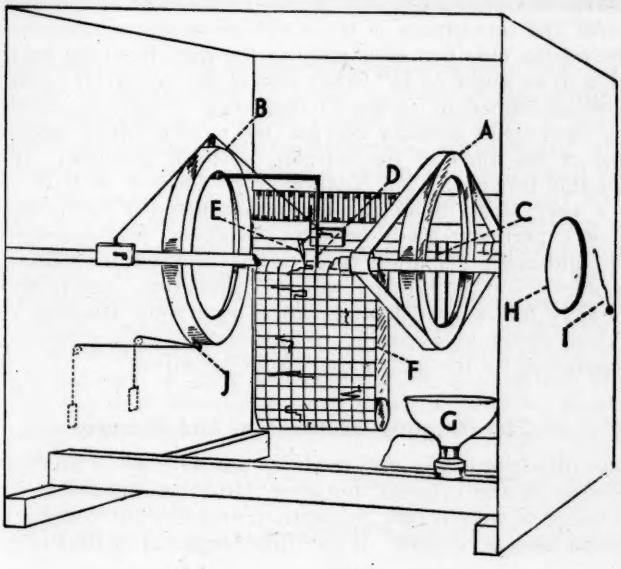
OWING to the interposition of mind in the reactive processes of the special senses, it is impossible to create values that are interchangeable between experimenters. The shape of objects, and the setting of them in the world about, is influenced so greatly by the nature of individual experience, that only the simplest mathematical configurations are capable of comparative representation through a common psycho-visual pathway. The effect of landscape upon a group of observers is sufficient testimony to the correctness of this statement. To one, the most impressive feature will be the hill in the distance, to another the spinney, to a third the pond. Where different objects in a scene become heavily accentuated, they tend to form points of reference to which the remaining objects radiate. Thus, without further consideration there is revealed a factor that seems to account for certain differences in the apportioning of space. Further, the tide of selectivity for detail may flow with considerable variation as to strength and induce as it were, + - phases. The observer who has spent his childhood in hilly surroundings acquires conversely a distaste for the desert. This is not because of an inherent negation for flatness, but because of an acutely sensitive memory of hills, whereby antagonism is induced. Sometimes, so strong are these + - phases that they can be projected into consciousness, and become the precursors of a neurosis. It is important to emphasise the points, because their influence may be carried into calculations that involve spatial judgment.

The object of this paper is to bring into the foreground certain features of binocular vision which do not appear to have received full recognition, and which, studied more fully, appear to have a close association with depth perception. Considered here, the term " depth perception " means the highest stratum of spatial recognition. While acknowledging that visual acuity and ocular muscle balance must play their part in shaping the framework to support the picture, they can exhibit deficiencies, which do not, however, detract from the full recognition of that quality recognisable as depth. It is considered that fine gradations in intrinsic or extrinsic muscle tone expressed as a kinetic stimulus assisting in the acute analysis of relative position do not possess

the full power to express themselves with consistent accuracy. This preliminary investigation has been carried out with the aid of two pieces of apparatus specially designed to analyse what are felt to be the sensations directly involved.

The Rotating Depth Perception Apparatus

This instrument was devised with the object of examining the nature of depth perception in its pure form by the elimination of as many secondary considerations as possible. The test is based upon the three pins of Helmholtz, but it has been made so that the pins can be rotated in parallel through the full range of the perimeter. The pins themselves are blacked, and of 1 mm. thickness. The background is a flat gray, and owing to the method of illumination, is entirely without shadows. There is no chance of using external points of reference. The observer's head is fixed in a head-rest and clamped to prevent artificial parallax, through conscious or subconscious lateral movements, and the cord by which the centre pin is moved is uniform in texture, and yields no clue. The distance between the two fixed pins and the observer is 11 feet. The range of movement of the centre pin is 240 mm. Attached to the centre pin upon the adjustment of which the judgments are made is a stylo pen, which runs



over graphed paper on a moving drum at a standard speed, so that *all* movements carried out in the process of re-setting the centre pin are recorded, and not merely the final judgment. This is a very important consideration. There is a special routine in adjusting the centre pin by the examiner, before each test. The points selected are, +4 −8 +5 −10 measured in cms., and zero. The four selected positions or rotations are vertical, horizontal, and 15° either side of horizontal. The examiner having set the centre pin according to this plan, asks the observer to move it back by means of his cord to what he feels is that position in which all three pins are equidistant from him. As four perimeter positions are employed, there are thus twenty separate tests to one graphic record. It is believed by this procedure that two visual characters are assessed, namely:

(i) The sensitivity of the retinae to stimulation at disparate points;

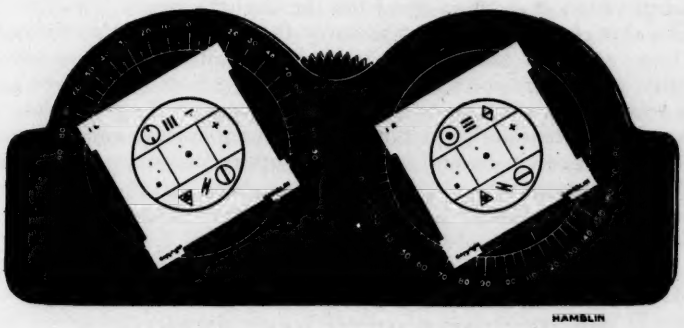
(ii) The psycho-visual response to such stimuli which calls for interpretation varying in acuteness according to the rotated position of the pins.

In the vertical position the full interocular base line allows assessment under normal conditions, while in the horizontal a situation is presented that is impossible to analyse accurately. Graphic records show great differences in character between individuals in their endeavour to align the pins set horizontally. The rôle and importance of binocular vision is well demonstrated by the results obtained after moving the pins from the horizontal position to an angle of 15° either side of horizontal, because there is often an immediate return of the power to analyse depth in a degree sometimes actually comparable to that which attends the setting of the pins in the normal, vertical, position. This is remarkable because, by a rotation from 180° → to 165° or 15°, only a very small binocular factor has actually been regained. Further experiment tends to show, however, that cases arise in which, although disparate point retinal stimulation occurs, and binocular vision is present without restriction, yet it does not necessarily follow that depths can be accurately assessed. There is a third factor necessary to complete the whole, that is clearly demonstrated by the instrument to be described.

The Rotating Stereogram and Pictures

This instrument was designed for the purpose of studying the behaviour of the eyes to the presentation of dissimilar objects, their range of stereoscopic perception, and also for treating defects in ocular muscle balance. If the upper segment of the first picture

of the series is examined through the Holmes stereoscope, it will be found arranged in the following fashion. The right eye sees a circle and dot, three horizontal parallel straight lines, and two triangles base to base. The left eye adds to this, two lines to the circle, three vertical parallel straight lines across the horizontal ones, and a dot in each triangle. Experiments with these charts have revealed clearly that the majority of observers experience alternate vision, and that there are marked variations in the quality alternation. This may be equally balanced, irregular, slow or rapid. The influence of the master eye may be very pronounced. It has been found that strong mastery tends to negative the faculty of depth perception, as also does the presence of a perfectly balanced



macular reception. These results seem to indicate that the comprehension of depth rests upon the presence of alternation, and upon the character and rhythm of that alternation. If this is so, then the processes concerned are dependent, not upon any specially attuned set of visual nerve fibres, nor upon an allotted cortical centre, but upon what might be termed sub-liminal alternate flicker. It is known that where one eye only is present accuracy in the spacing of objects depends largely upon lateral movements of the head. If the head is fixed in a vice, accuracy is at once considerably reduced. This habit of head shifting in those who have become uniocular is acquired naturally. So it seems that where a series of objects in space is regarded either predominantly through one eye or with perfect evenness of reception through both, the essential parallactic effect brought about by alternation is missing, and accurate analysis with regard to relative position becomes faulty.

It is possible by means of the rotating stereogram to develop the stereoscopic sense in those who at first have no acute understanding concerning relative position in space. The procedure is

to work at first upon dissimilar objects and adjust the macular reception rate until a point is reached where marked neglect or long period alternation is replaced by rapid and equal periodicity. Attention is then given to the stereoscopic sections of the pictures. It will be found that having attacked unbalanced alternation, a situation is arrived at in which depth may now be appreciated. This achievement adds weight to the contention that alternation is essential for complete and accurate spatial orientation. Much work remains to be done with regard to the more detailed analysis of alternation in the optimum balance required to produce the greatest depth effect. It must be known what influences the master eye brings into the picture as a stabilising factor and centre of reference; and, what effects has the angle of separation of the line of vision of such an eye from the sagittal line.

To this end it is intended to carry these investigations through a large series of cases and in each instance to examine:—visual acuity with refraction; muscle balance including master eye and its relative ascendency over the other eye; depth perception as recorded by the rotating depth perception apparatus; and, the state of binocular reception and stereoscopic appreciation as studied with rotating stereogram.

ON DISABLEMENT AND SOCIAL CONDITIONS OF PATIENTS WITH PAST SYPHILITIC INTERSTITIAL KERATITIS*

BY

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I HAVE examined material comprising 173 patients with past interstitial keratitis. Of these patients 124 answered a call for re-examination while 49 were encountered accidentally in the course of this work. As to the gathering of this material I beg to refer to my book: "Keratitis parenchymatosa luica og dens Fœlgetilstande."[1]

The average age of these 173 patients was 32 years, with an average observation period of 20 years, the longest observation period covering 56 years. In the present paper I shall try to give an account of my findings concerning the disablement and social conditions of these patients.

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In estimating the degree of disablement, I have based my judgment, for one thing, on the statements made by the patients themselves, as these data generally will illustrate the practical means of subsistence of the patients and hence afford a rather essential foundation for an appraisal of the fate of these patients.

Through these investigations, however, it turned out that the actual earning capacity of the patient did not always correspond with my findings on examination. Thus, for instance, some patients were able to get along remarkably well in spite of a very considerable decrease in their power of vision. In estimating their disablement, therefore, I have also made use of the calculation on which the public disablement insurance here in Denmark is founded.[2] In this way I have arrived at a uniform estimation of the material, especially with regard to the mild degrees of disablement that do not assert their presence in any particular decrease in the practical earning capacity of the patients.

As to the social condition of the patients I have tried to obtain information about any family history of syphilis in the parents and in the brothers and sisters, the number of sisters and brothers, whether the patients have been married and have had any children, and how the health of these children has been. Finally, through comparison between the living conditions of these patients and of their parents I have tried to elucidate whether the disease has lowered the individual patient socially. This information has quite naturally, for the sake of discretion, often been very difficult and sometimes impossible to obtain. In this connection, it may be stated here that among the total number of patients covered by this re-examination—173 altogether—96 (*i.e.* 55 per cent.) knew that they were suffering from congenital syphilis, while 45 (*i.e.* 26 per cent.) apparently knew nothing about their illness, and in 32 cases (*i.e.* 18 per cent.) it could not be ascertained whether the patients knew anything about the nature of their illness.

In speaking of the disablement of patients with syphilitic interstitial keratitis, we have also to reckon with the disability due to the acute eruption of the disease itself. As the acute eruption in most cases occurs at school-age, this disability will chiefly involve absence from school. With a view to this point, Carvill and Derby[3] have reported that in a material of 200 cases 54 patients had to miss school for a period from 1 month to 3 years, whilst 31 had been able to attend school without any particular inconvenience. In 96 patients this morbid condition went on to permanent disablement.

We have to reckon it as a socially favourable fact that the keratitis usually manifests itself at such an early age that the patient has not yet commenced any occupational training, so that it will yet be possible to decide his future occupation according

to his present strength of vision. There are, however, a good many cases in which the keratitis does not appear until the patient has entered into a certain occupation, and if this work requires a greater strength of vision than is left by the keratitis, the patient will have to look around for some other occupation, as a rule with smaller income.

How often this happens in practice, Igersheimer[4] has tried to elucidate by questioning a fairly large number of patients with past interstitial keratitis. It was found that owing to the decrease in their power of vision several of these patients had been forced to adopt some simpler, less exacting, trades; but in these occupations they were fully able to compete with their normal fellow workers.

In my investigation, as already mentioned, I have paid particular attention to the question whether the disease has caused such a degree of disablement that it has impaired the practical earning capacity of the patient. In my material it was found that 79 per cent. of the patients stated themselves that they were perfectly capable of work, while 7 per cent. were only partially able to work, and 14 per cent. were disabled probably to a degree less than one-third of normal working capacity. As far as the statements made by the patients are concerned, one has to admit that these patients on the whole are getting along fairly well, even though the 14 per cent. with severe invalidity must be considered a considerable social encumbrance.

In the main, the statements made by the patients have agreed very well with the physician's estimation in the appraisal of the disablement. Only 3 patients, in their own opinion, gave a reduction in earning capacity that was considerably greater than could be demonstrated objectively. On the other hand, 2 patients testified to a very good working capacity in the trades they had selected, even though their disablement on physical examination was rather considerable; one was completely deaf, the other was a blind organ player.

In my material the symptoms causing disablement have been: impairment of vision, deafness, and nervous complications. In the aforementioned calculation of disablement I found that 51 per cent. of the patients showed a disablement of 0 per cent.; 55 per cent. of the patients showed a disablement of 5-20 per cent.; 9 per cent. of the patients showed a disablement of 25-60 per cent.; and 16 per cent. of the patients showed a disablement of 65-100 per cent. By far the most frequent cause of disablement was impairment of vision, as this complaint appeared in 92 per cent. of the cases—and it was the only complaint in 72 per cent.—whereas deafness was the cause of disablement in 27 per cent., and nervous complications in 3 per cent.

TABLE I

I	II		III		IV
»onset age« of deafness	entire material		number of deaf		%
1	173		0		
2	173		0		
3	173		0		
4	173		0		
5	173		0		
6	173	173	0	5	2,9 %
7	173		0		
8	173		2		
9	172		2		
10	172		1		
11	172		0		
12	172		0		
13	171		0		
14	168		3		
15	165		1		
16	164	163	1	10	6,1 %
17	160		1		
18	158		1		
19	154		1		
20	148		2		
21	144		0		
22	139		1		
23	132		0		
24	125		0		
25	120		0		
26	109	114	0	3	2,6 %
27	102		2		
28	96		0		
29	89		0		
30	86		0		
31	84		2		
32	79		0		
33	73		0		
34	63		0		
35	57		0		
36	52	58	0	4	6,9 %
37	47		0		
38	44		1		
39	42		0		
40	41		1		
41	40		0		
42	35		0		
43	32		1		
44	29		0		
45	27		0		
46	26	28	0	2	7,1 %
47	24		0		
48	23		1		
49	20		0		
50	20		0		
51	20		1		
52	17		1		
53	15		0		
54	12		0		
55	11		0		
56	10	11	0	3	27,3 %
57	9		1		
58	8		0		
59	7		0		
60	5		0		

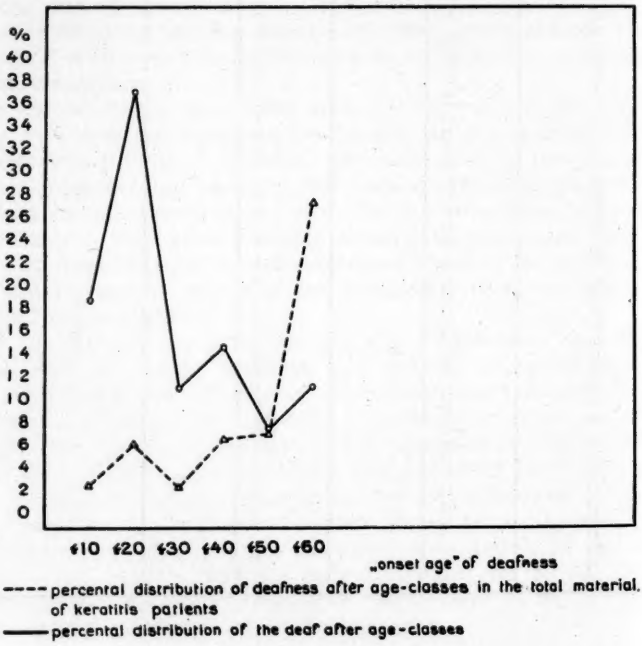
Among the pathological changes in the eye that I found to be the cause of impairment of vision, corneal opacity was the most frequent, while refraction anomalies and choroiditis were considerably less frequent; and cataract and bulbar phthisis were even more infrequent.

With the exception of bulbar phthisis, which always is associated with a considerable decrease of vision, all the other morbid conditions mentioned above occasioned more or less severe impairment of vision.

After this there can be no doubt that impairment of vision is the most frequent cause of disablement. Here, however, we have to keep in mind the degrees of disablement involved. As to deafness, it is the general rule that this affection always implies a severe degree of disablement (50 per cent., after the scale here mentioned), even though experiences show that the practical earning capacity is not always lowered correspondingly.

As to the ear complications, I found, in my material, several interesting conditions that have been mentioned more fully in a

Fig. 1



previous paper[5] on the correlation between syphilitic interstitial keratitis and deafness. Here I shall merely give a brief summary of the more important results. The material was particularly suitable for an inquiry into the relation between ear complications and eye lesions, as none of the patients was summoned on account of his or her ear lesion. Ear complications were present in altogether 15·6 per cent. of these patients. A tabulation of these patients according to the age at which the deafness appeared, shows that the most frequent " onset age " is the decade of 10-20 years—what is quite in keeping with the findings reported by previous investigators. See Table I.

For further elucidation of the percentage distribution of deafness in this material, the findings are plotted graphically in Fig. 1 (dotted line) and for comparison, another curve (solid line) is plotted for the percentage distribution of the total number of deaf after age-classes.

From Table I and Fig. 1 (dotted line), an interesting fact is evident that has not been noticed previously, which was not at all evident from the immediate percentage distribution of the deaf (solid line), namely: that by far the greatest percentage of these patients become deaf as late as at the age of 50-60 years.

In order to illustrate how often we can expect to find patients with a past history of congenital syphilitic keratitis to become deaf in the different age-classes—that is, the percentage of deafness and its variation with increasing age—I have tabulated the material as shown in Table II.

In Table II the first column represents the age of the patients. Column 2 gives the total number of patients (173) observed in the first years of life; subsequently the number of patients is reduced by subtraction of the cases that were no longer under observation. Thus the figures indicate how many patients under observation have passed their respective age-classes.

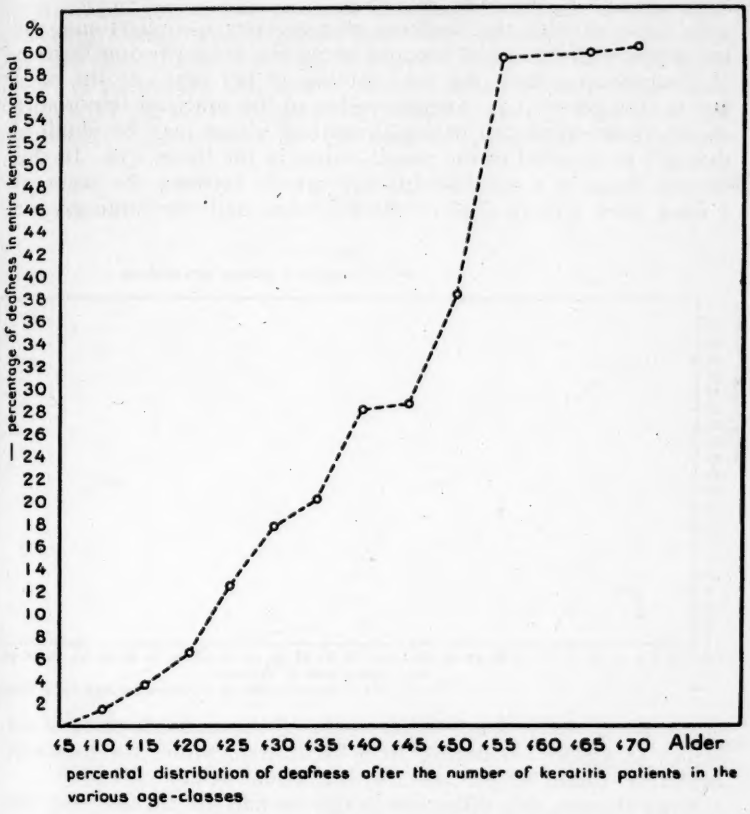
In column 3 the individual figures tell us how many of the patients (in column 2) have been found to be deaf in the corresponding age-classes. The figures in column 4 give the percentage of deafness calculated for the various age-classes (of 5 years each).

From Table II it is quite evident that the percentage of deafness is increasing greatly with the age of the patients. Even at the age from 30 to 55 years the percentage frequency of deafness is very considerable, and in the age-group of 55-70 years the percentage rises to values representing more than one-half of the patients in that group. For further illustration of this interesting finding, the percentage distribution of deafness after the number of keratitis patients in the various age-classes is presented graphically in Fig. 2.

TABLE II

I	II	III	IV	
age	entire material	deaf	deaf in percentage of entire material	
1	173	0	0 %	
2	173	0	0	
3	173	0	0	0 %
4	173	0	0	
5	173	0	0	
6	173	0	0	
7	173	0	0	
8	173	2	1,2	1,3 %
9	172	4	2,3	
10	172	5	2,9	
11	172	5	2,9	
12	172	5	2,9	
13	171	5	2,9	3,8 %
14	168	8	4,8	
15	165	9	5,4	
16	164	9	5,4	
17	160	10	6,0	
18	158	10	6,0	6,5 %
19	154	11	7,1	
20	148	12	8,1	
21	144	12	8,3	
22	139	12	8,5	
23	132	11	8,3	8,6 %
24	125	11	8,8	
25	120	11	9,1	
26	109	11	10,0	
27	102	12	11,8	
28	96	12	12,5	12,3 %
29	89	12	13,5	
30	86	12	13,9	
31	84	14	16,7	
32	79	13	16,5	
33	75	13	17,3	17,8 %
34	63	12	19,0	
35	57	11	19,3	
36	52	9	17,3	
37	47	8	17,0	
38	44	9	20,5	20,1 %
39	42	9	21,4	
40	41	10	24,4	
41	40	9	22,5	
42	35	9	25,7	
43	32	10	31,2	28,0 %
44	29	9	31,0	
45	27	8	29,6	
46	26	7	26,9	
47	24	6	25,0	
48	23	7	30,4	28,5 %
49	20	6	30,0	
50	20	6	30,0	
51	20	7	35,0	
52	17	6	35,0	
53	15	5	33,3	38,1 %
54	12	5	41,6	
55	11	5	45,5	
56	10	5	50,0	
57	9	6	66,6	
58	8	5	62,0	59,1 %
59	7	4	57,1	
60	5	3	60,0	
61	5	3	60,0	
62	5	3	60,0	
63	5	3	60,0	59,3 %
64	3	2	66,6	
65	2	1	50,0	
66	2	1	50,0	
67	2	1	50,0	60 %
68	1	1	100	
69	1	1	100	

Fig. 2



percental distribution of deafness after the number of keratitis patients in the various age-classes

In my material every instance of deafness develops subsequently to the manifestation of keratitis. The interval between keratitis and deafness varied from 1 to 31 years, and it was found to increase with the age of the patient at the manifestation of keratitis. These findings are presented graphically in Fig. 3.

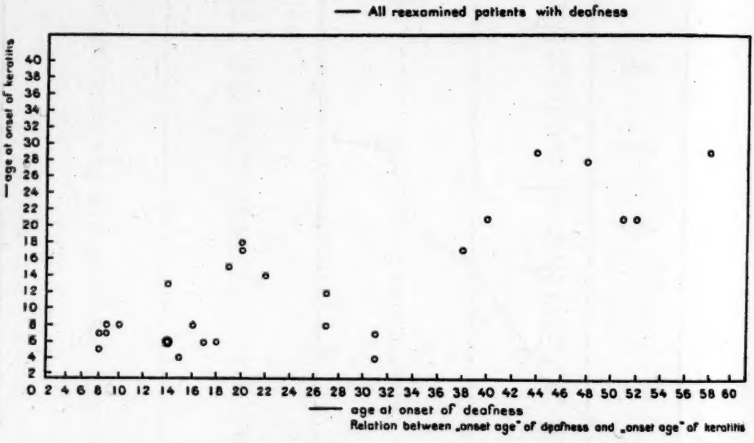
Deafness appeared preferably in those patients in whom the keratitis had taken a more malignant course, and in whom there appeared also other syphilitic symptoms.

As far as nervous complications are concerned, they too brought about a severe degree of disablement in those cases where they were disabling at all. It is to be mentioned at the same time, however, that nervous complications were present in 10 additional

patients in whom they had not left any disablement that could be demonstrated at the re-examination.

In contrast with the deafness and nervous complications, the impairment of vision has brought about the most varying degrees of disablement—from the very mildest (5 per cent.) to the most severe (100 per cent.). An impression of the practical importance of the disablement due to impairment of vision may be obtained through an account of the visual acuity in the better eye. In this respect there is a considerable divergence between the accounts I have been able to find in the literature and my findings. In

Fig. 3



Relation between „onset age" of deafness and „onset age" of keratitis

my material only about 5 per cent. of the patients showed an acuity of vision amounting to 6/24 or less, while, for instance, Seefelder[6] found 49 per cent. with a visual acuity of < 6/36.

Even though this difference is due in part to the fact that my material, on an average, has shown a slight degree of disablement —owing perhaps to the long observation period—it is largely and decisively due to the fact that my account covers also the normal eyes in patients with unilateral keratitis. Here, I may add that unilateral keratitis was found in 17 per cent. of my patient material.

As to the disablement, it was found that on comparison of the length of the observation period with the percentage of disablement, the disablement was increasing markedly with the length of the observation period. In this investigation I have had to rule out a part of my material—namely, those patients who might be regarded as selected as far as disablement is concerned, as some of them had sought medical advice of their own accord and

others were hospitalized when they turned up for the re-examination. This leaves 122 patients distributed in such a way that, working with groups of 5-year observation periods, the percentage of disablement after an observation period of 0-5 years was 0 per cent. (2 patients); 6-10 years: 5·5 per cent. (20 patients); 11-15 years: 9·7 per cent. (22 patients); 16-20 years: 12·2 per cent. (20 patients); 21-25 years: 25·5 per cent. (24 patients); 26-30 years:

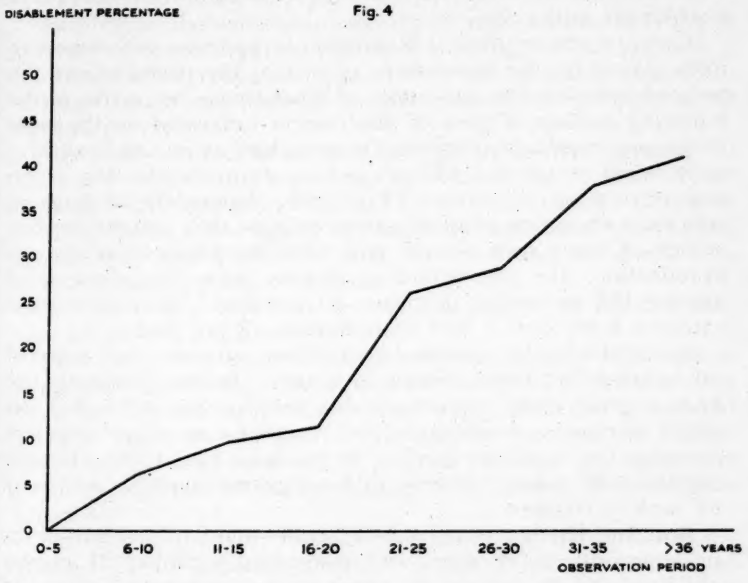


Fig. 4

28 per cent. (15 patients); 31-35 years: 37·5 per cent. (10 patients); over 36 years: 40·5 per cent. (9 patients). These findings are presented graphically in Fig. 4.

Among these 122 patients 40 had not previously received any antisyphilitic treatment. Naturally most of these untreated patients belonged to the older age-groups; and they all had an observation period of more than 21 years, distributed as follows:

	years			patients
Observation period of	21-25	26·7 per cent.	disablement in	12
,, ,,	26-30	25·8 ,,	,,	12
,, ,,	31-35	40 ,,	,,	7
,, ,,	> 36	40·5 ,,	,,	9

Here, too, we find that a high disablement percentage corresponds to a long observation period. It does not seem possible from a comparison of the disablement percentage in treated and untreated patients to arrive at any sure conclusion as to the influence of treatment upon the degree of disablement. The rise of the disablement percentage with the observation period in my material is due to the development of cataract, cyclitis, choroiditis, and glaucoma, as far as the eyes are concerned, and to deafness and nervous complications, whereas heart disease plays a strikingly minor rôle.

If we try among these 122 patients to appraise the respective rôles played by the impairment of vision, the deafness and the nervous complications as causes of disablement, we arrive at the following average degrees of disablement calculated on the basis of the total material (comprising non-disabled as well as disabled): impairment of vision: 13·1 per cent.; deafness: 6·5 per cent.; and nervous complications: 0·8 per cent. Among the 49 patients, selected with a view to disablement because they sought medical advice of their own accord and were hospitalized at the re-examination, the corresponding figures were: impairment of vision: 14·7 per cent.; deafness: 8·1 per cent.; nervous complications: 4 per cent.; and heart disease: 2 per cent.

As to the social conditions of these patients, the required information has been difficult to obtain. In the literature, one finds a good many reports on this subject, but often they are rather divergent. Hochsinger[7] has reported a serial investigation covering 134 syphilitic families in which he found 253 still-born children, 263 living children with congenital syphilis, and only 53 healthy children.

Boas and Rœnne[8] examined 33 families and found 37 still-births or abortions, 47 children with congenital syphilis, 27 normal children, and 21 children on whom no accurate examination had been performed.

In my material 120 families had altogether 469 children, 200 of whom were suffering from congenital syphilis. The greatest number of children with congenital syphilis in one family was 7. I was not able to obtain reliable information about the number of abortions and still-births in these families.

As a matter of course, naturally, either the mothers or both parents of the interstitial keratitis patients must have had syphilis. For an estimation of the milieu in which the keratitics grew up it would be of particular interest to obtain information about the extent and degree of syphilitic symptoms noticed in the parents of these patients. Several difficulties were encountered however, in trying to obtain this information.

As mentioned already, a great many of these patients did not

know that their eye lesion was due to congenital syphilis. In other cases the syphilis in the parents had taken a latent course or merely given symptoms that could not be attributed with certainty to the presence of syphilis. Some of the patients have never known their parents; in other cases the parents had died, often many years before this investigation, and frequently the cause of death was not fully established. In my material, 36 out of 110 patients were able to state that both parents or the mother had been syphilitics.

Turning to the subsequent records of my patients, it is found that out of the 173 patients 98 were married (*i.e.* 57 per cent.). Their average age was 32 years. I have not been able to find out whether matrimony among normal persons at the age of 32 exceeds 57 per cent.

As to the number of children of the 98 married patients, 30 had no children; the remaining 68 families had a total of 142 children. Of these 142 children 7 died from unknown causes in infancy, 2 died at the age of 2 years, 3 had attacks of epileptiform convulsions, and 4 were delicate. Abortion and still-birth were said to have happened in 4 cases.

In 7 cases the Wassermann test was applied to the children, who all gave a negative reaction.

Thus these 98 married keratitic patients had only 142 children altogether—something that agrees very well with the statement made by Igersheimer,[4] that women who have had interstitial keratitis often are sterile. In the account reported by Sidler-Huguenin[9] it was found that 28 per cent. of such marriages were childless, and that 36 such marriages only resulted in 65 children altogether.

The above, however, has not been confirmed by other investigators. Thus, Treacher Collins[10] found a normal number of children (4) in families where the mothers gave a past history of interstitial keratitis. Nor did Husler and Wisskoff[11] find any evidence in their material of patients with past interstitial keratitis of reduction in the capacity for reproduction. On the other hand, Treacher Collins[10] found that a strikingly large number of these children (26 out of 60) died in their first years of life. As pointed out above, my findings point in the same direction.

As to signs of congenital syphilis in children born by mothers with a past history of interstitial keratitis, they might be expected *a priori* to be rare, as the congenital syphilis of the mother has already reached a late stage at the time the child is born. This view is confirmed on investigation into this particular point: Igersheimer[4] obtained a negative Wassermann reaction in all the 12 children of past-keratitic mothers he examined, and Sidler-Huguenin[9] obtained a negative Wassermann reaction in 44 out of 45 children examined.

Concerning the occurrence of syphilis in three generations the reader is referred to two papers by Haldimann[12] who in 1936 and 1937 reviewed the literature dealing with this question and found altogether 13 cases of patients with eye symptoms suggestive of the presence of syphilis through three generations. Also Bergmeister[13] and Manchot[14] have reported some cases of that kind. My material includes no sure case of this kind.

In conclusion I shall merely mention that from the patient's occupations I have tried to gain an impression as to whether the disease may conceivably bring about a reduction in their social standing.

In a group of 51 patients who were investigated, especially with a view to this particular feature, it was found that 38 occupied the same social state as that of their parents, while 7 had advanced socially and 6 had gone down. Practically all the parents belonged to the working and trade classes, and the same applies to the re-examined patients, so that it seems safe to say that the disease has not occasioned any particular social reduction.

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ON THE TREATMENT WITH "GLAUCOSAN" OF CASES OF GLAUCOMA OPERATED UPON WITHOUT SUCCESS, AND OF COMPLICATED CATARACTS

BY

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How are cases of glaucoma to be treated, in which an operation has either been unsuccessful, or resulted in only a temporary success in spite of regular application of eserine and of pilocarpine even subsequent to the surgical operation?

In 1923, Prof. W. Uhthoff, Chief of the University Clinic, Breslau, wrote in *Deutsch. med. Wochenschr.* ("On the treatment of glaucoma," p. 7): "Woe to the patient who loses courage too soon and refuses further operations!" This will be the opinion taken even at present by ophthalmologists. As soon as a suggestion is made to perform another operation in the near future, the patient will answer with the fearful cross-question: "But will this next operation lead to a successful result? Or will it possibly result in a change for the worse?" The decision is one of the most serious duties incumbent upon an ophthalmologist, because the operation will affect a seeing eye, and not an eye which has grown blind, as in the case of senile cataract.

The post-operative tension of the eye will often continue to be high, not only in simple glaucoma, but also in many cases of acute glaucoma after operation. The "attack," the steaminess of the cornea, the disturbance of vision, the pain, the nausea, are removed, but the tension will continue to amount to 40 or 50 millimetres; in such cases as, for instance, the case published by Dr. W. Rauh (*Zeitschr. f. Augenheilk.*, Vol. LXXIII, 1930) and also the cases described in my own publications (*e.g., Klin. Monatsbl. f. Augenheilk.*, Vol. LXXXIX, 1932, p. 366, and also in my book "Selbstheilung hoffnungsloser Krankheiten," [Spontaneous cure of hopeless diseases], G. Fischer, Jena, 1928, p. 37) simple glaucoma has already been present,—though unperceived,—a long time ago, and only the permanently high tension, in spite of the cornea being transparent, gave a clear insight into the character of the disease; in such cases there exists also an excavation of the optic nerves, whereas such an excavation is absent in an *acute* glaucoma affecting an hitherto healthy eye.

In my experience a second or another repeated operation for glaucoma ought not to be recommended prior to a preceding tentative treatment with glaucosan drops.

The operations concerned here are iridectomy and trephining.

The glaucosan drops* introduced by me in 1926, have become firmly established in ophthalmology. They are applied principally in severe iritis and in secondary glaucoma, *i.e.*, annular adhesion between iris and lens. Prof. Stock of Tübingen writes as follows: " In such cases not infrequently the results have been simply splendid: The pupil dilates, adhesions separate, the glaucoma disappears." (*Klin. Monatsbl. f. Augenheilk.*, Vol. LXXXI, p. 695, 1928.)

Though no doubts can exist any longer as to the value of the preparation in this type of glaucoma, two cases may be published here,—because of their typical character,—the first with due regard to the retarded effect, and the other, because the eye had been declared to be definitely lost by an experienced consulting ophthalmologist, unless it were operated upon forthwith.

Case One.—Hairdresser, aged 60 years. Had iritis repeatedly. On November 6, 1936, glaucomatous iritis, *tension* 50. Vision: Finger at 1 metre, *i.e.*, practically blind. One day afterwards glaucosan drops, ample dose, at first without any effect. Following day: " Repeated strong dose of glaucosan." Another day later (on November 8) the eye suddenly cleared, the pupil became round, tension 22, vision 5/7. Last heard of almost one year later on: " Acute secondary glaucoma cured, visual acuity preserved."

Case Two.—Mrs. R. G., aged 46 years, cyclitis tuberculosa; Alpine cure unsuccessful; serious relapse in June, 1937, tension 40, vision 1/60, *i.e.*, almost blind (prior to this relapse: 1/4). On July 20, 1937, consultation with famous specialist, who advised as his opinion: " Immediate operation " is the only way. The attending physician, Dr. F. Langendorff,† however, insisted on a previous glaucosan treatment. Patient was treated for about three weeks with glaucosan drops up to four times a day. Left clinic with same vision as before, 1/4 without any operation. Tension last measured 10 months later, when it was 20 mm., the splendid results thus being permanent.‡

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* Source of supply: Chemische Fabrik of M. Woelm at Eschwege, near Cassel, Germany, " Glaucosan Drops " are identical with Laevorotatory Glaucosan.

† I am indebted to Dr. L., 838, Riverside Drive, New York, also for the information on Case 1. All the observations and opinions, as far as they have not been published in the literature, are contained in private letters remitted to me, I having been authorised to use them for publication.

‡ See Professor Wegner, Ophthalmic University Clinic, Freiberg, " Zeitfragen d. Augenheilkunde," Published by Enke, Stuttgart, p. 348, 1938. " All of you are aware of the fact that these increases in tension, obtaining in eye tuberculosis. offer almost insurmountable difficulties . . . A perfectly indispensable and unequalled preparation for such cases is offered by Hamburger's glaucosan, of which I stated already in 1926 that its principal field of use are cases of secondary glaucoma."

What is remarkable in this case, is the application of glaucosan several times a day for some weeks; in the case of patients of higher age, from about 65 years upward, a much more cautious treatment would be necessary because of the possibility of necrosis, though I have at no time whatsoever observed such a case of necrosis.

As far as the most frequent type of glaucoma is concerned, *i.e.*, simple glaucoma, most ophthalmologists gave up again glaucosan drops in view of the risk of an acute attack. Since the time when I commenced using a circumscribed massage with glaucosan (see below), in the place of a treatment by instillation, I have not observed any more even one single attack after the use of glaucosan. In excised and trephined eyes I did not even observe one single acute attack due to glaucosan at any time whatsoever; should such an attack occur at all, it must certainly be a rare accident, as has been confirmed to me by experienced clinical specialists. Prof. Fehr, for instance, who directed for a period of almost 30 years the large ophthalmological department of the Rudolf Virchow Hospital at Berlin, writes as follows:

"To-day, 12 years after its introduction by C. Hamburger, no one denies that thanks to its combined effect of dilatation of the pupil and decrease of tension glaucosan is the preferred therapeutic agent in all cases of iritis and uveitis accompanied by an increase in tension. It is also generally recognised as the therapeutic agent in iritis for adhesions which are not separated by atropine. In this field glaucosan has become an indispensable adjunct of all ophthalmological therapy.

" There are also other indications in which glaucosan is proving of great value, *viz.*, in the frequent cases in which iridectomy or Elliot's trepanation had no or only temporary success and high tension persisted; as far as I know, this field of use of glaucosan has not yet been mentioned in the literature. In these cases acute attacks due to maximum pupil dilatation need not be apprehended as they occur in cases of primary glaucoma not yet operated upon, and have restricted the field of indications of glaucosan treatment. At least, I have never observed any, although I used glaucosan frequently in such cases. In most cases the tension dropped, frequently to the normal level, remaining often at normal even after discontinuing glaucosan and applying pilocarpine and eserine which previously had been ineffective,—thus avoiding the need for another operation. Glaucosan gives particular relief to patients in whom the continued use of miotics has led not only to gumming of the margin of the pupil, but also to pigmentation of the capsule in the contracted pupillary region, whereby vision was reduced. Dilatation of the pupil by glaucosan, even if only slight because of adhesions, improves vision at once, due to an improvement

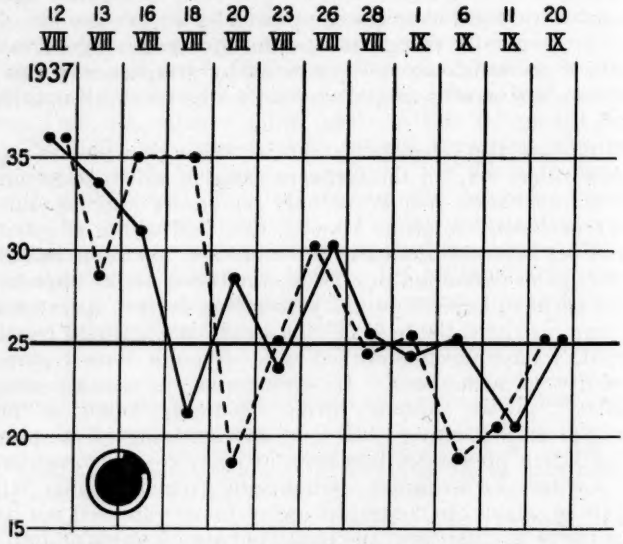
of the optical conditions. One must not yield to the temptation of applying glaucosan for some considerable time without interruption, still less to let the patient use it without any control; we must always realise that glaucosan is a highly specialised therapeutic agent as has always been stressed by the author."

Particularly encouraging is the fact emphasized in this summarizing opinion that now frequently,—by the aid of the glaucosan drops—it has been possible to avoid the need for another operation. In order to corroborate further the statement, two graphs and two histories of patients may be cited, one after a ten months' period of observation, the other having been observed for more than ten years.

Curve 1. The curve is that of a merchant, 59 years of age, who underwent iridectomy on both eyes—technically perfect—nine months ago, on account of simple glaucoma, but without any success. Tension 36 in either eye in spite of regular application of miotics. A new operation on both sides was proposed, *i.e.*, a third and fourth, but declined by the patient.

One eye sees only eccentrically and is practically blind, the other having almost half normal vision.

CURVE 1

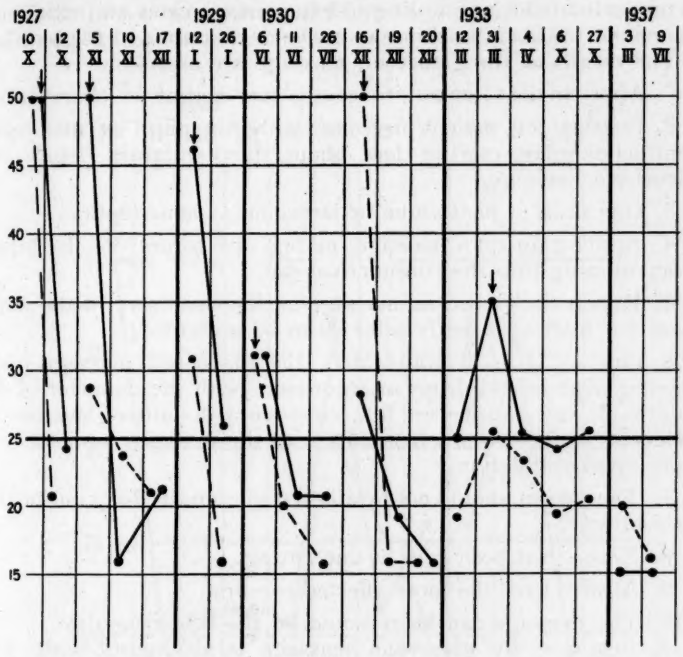


GRAPHIC RECORD ONE.—Pupil of an iridectomised eye, concentrically dilated by instillation of glaucosan. For details see essay. The configuration taken by the eye in case of massage with glaucosan, can be seen from Curve 3.

By glaucosan with subsequent application of eserine the tension was kept normal. At the first instillation only the worse eye was treated and given only one drop as a precaution. At the second treatment two drops were given. Tension dropped to 21 from 36, and to 18. After this favourable experience the better eye was also treated with this extremely cautious dosage. An acute attack did not occur at any time whatsoever.

Curve 2.—Miss R. J., Berlin, a former teacher, now 64 years of age, and 52 years upon the commencement of the treatment in

CURVE 2. For details see essay.



1927, underwent ambilateral iridectomy twenty years ago for simple glaucoma, technique excellent (operation performed by Prof. Silex). Tension 50 on either side. Vision 5/7 and 5/15, but visual fields already greatly damaged. Lately has been suffering from sudden blacking out and iridisation in spite of eserine. Thus operation was in fact unsuccessful. My observations commenced in January, 1927, *i.e.*, almost 11 years ago. In view of the long period of observation the graph only shows typical tests. It shows that occasional rises (for instance in January, 1929) are

always mastered by glaucosan. Patient has for many years been instilling the drops herself one to two times per week, as she can usually tell when the tension is too high. Acuity of vision, and also field of vision have been impaired, as they are bound to suffer in all cases of this chronic disease. Operation cannot prevent it either; *cf.* enormous tension in January 1927 at the commencement in spite of previous operation: 50 mm. Hg.

Ophthalmologists intending to be particularly cautious, because they are afraid of an acute attack, may avail themselves of the method of massage with glaucosan (Gl.=M.) in the place of instillations. Thereby the dilatation ad maximum of the pupil is prevented, which according to experience creates an inclination to attacks. Gl.=M. aims at an *eccentric* dilatation of the pupil.

The details of the glaucosan massage are as follows:—

1. Apply in the forenoon, to leave plenty of time for observation.

2. Instruct the patient to come with his pupil at maximum contraction; last eserine dose about thirty minutes before the glaucosan massage.

3. One drop of pantocaine or larocaine as anaesthetic.

4. Apply glaucosan massage, taking care to prevent the liquid from running into the conjunctival sac.

5. Repeat the glaucosan massage on the same spot, if the pupil does not react sufficiently after 20 to 30 minutes.

6. One to 1½ to 2 hours after the glaucosan massage instil eserine or physostol drops in accordance with the diameter of the pupil. If any scruples are felt, massage with amino-glaucosan (2 per cent. or 7 per cent. histamine), as the irritation is much less than upon instillation.

7. The patient should not be allowed to go until the pupil begins to contract.

8. Never treat both eyes at one sitting.

9. Always treat the more affected eye first.

10. The massage can be repeated on the following day.

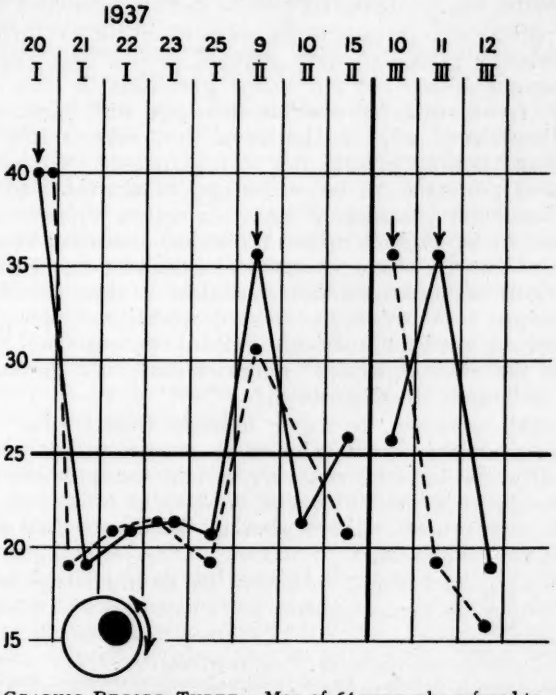
A treatment by glaucosan massage is also particularly well suited to the purpose of examining the optic nerve in the case of such eyes where there exists a suspicion of glaucoma, in view of the eccentric dilatation of the pupil brought about, and also for the purpose of removing adhesions of the iris to the capsule of the lens after a cataract operation. Many post-cataractous discissions have in such cases been rendered dispensable by a massage with glaucosan. It is furthermore advisable in order to form an opinion as to whether an optical iridectomy—in a case of a corneal leucoma, etc.,—will be successful. "In the most

satisfactory manner I have been able to bring about the local, eccentric dilatation of the pupil by means of laevorotatory glaucosan." (Franz Gnad, Elschnig Clinic at Prague, "On the manner in which pupillo-motoric agents display their effect, if applied upon local restriction of the area treated," *Klin. Monatsbl. f. Augenheilk.*, Vol. LXXXIV, p. 512, and Dr. M. Vannas: "*Eccentric* Mydriasis upon ascertaining the indication of an optical iridectomia," *ibid.*, Vol. LXXX, p. 482.)

Curve 3 may be mentioned as a proof of the effect attained also in the case of glaucomatous eyes (simple glaucoma) not having been operated upon.

Curve of a business man of 64 years of age, bilateral glaucoma simplex, so far untreated. One eye sees only eccentrically, and

CURVE 3



GRAPHIC RECORD THREE.—Man of 64 years who refused to be operated on for simple glaucoma. Massage with glaucosan on January 20, 1937. Attention is drawn to the "sympathetic effect," *i.e.*, the effect conveyed to the other eye (after massage). In January, 1937, treatment of the worse eye, the better eye having been treated later on, *i.e.*, in March. Attention is drawn to the eccentric dilatation of the pupil.

is practically blind. The better eye has about half normal vision. Tension bilaterally 40 in spite of eserine, etc. Patient refused operation. On January 20, 1937, glaucosan massage of bad eye. Tension fell to 18 bilaterally. (Sympathetic conveyance of the stimulus thus also obtains in the case of glaucosan massage.) The curve indicates the intensity and duration of the effect. After about a fortnight (February 9) the massage was repeated on the same eye with the same effect. Contraction after 2 hours. The better eye was then similarly treated. Energetic massage on March 3, ⅓ of peripheral cornea for 10 seconds. This time there was no sympathetic softening. Contraction of the pupil was this time brought about by massage with amino-glaucosan—Wölm,* 2 per cent., because the better eye was concerned. Treatment later on repeated from time to time. Tension continued to be normal in the better eye. (Measured for the last time on May 6, 1938.)

The patient who refused to be operated on the eye (tension 40) would without glaucosan have suffered serious damage, or even have become blind. When using glaucosan in this cautious manner, I emphasize once more: massage with glaucosan, and at the beginning only on the *worse* eye, even a sole eye can without any hesitation be treated with glaucosan. Or would it be considered preferable to leave the patient untreated to himself, *i.e.*, to inevitable privation of sight,—a patient whose eye tension continues to be high in spite of miotics,—because, deterred by the fate of the other eye, operation was declined by him?

Dr. Haitz of Mayence (*Klin. Monatsbl. f. Augenheilk*, p. 937, 1939, writes: "A patient has refused operation, under glaucosan his better eye has kept invariably well for two years and a quarter, whereas the *other*, operated on before, has been getting *slowly worse* (enlargement of scotoma)."

It would, moreover, be wrong to desist from further treatment with glaucosan, if the tension does not *immediately* fall to a sufficiently low level. Even after several weeks or even months I observed a reduction in tension down to 13 or 12 mm. Schiötz, even in cases where at the beginning the tension had only been reduced from 32 to 25.

In this regard I would, however, like to emphasize as much as possible that, as far as patients are concerned who have already

*W. S. DUKE-ELDER and F. W. LAW, *Brit. Med. Jl.*, March 30, 1929; S. R. GIFFORD, *Amer. Jl. Ophthal.*, August, 1928, and *Arch. of Ophthal.*, November, 1928; D. K. PISCHEL, *Amer. Jl. Ophthal.*, September, 1928; MANNO VANNAS, *Klin. Monatsbl. f. Augenheilk.*, Vol. LXXXIII, 1929; FRANZ GNAD, *Prag. ibid.*, April, 1930; see also *Bericht der Ungarischen Ophthal. Ges. ibid.*, August, 1936; Prof. PETERS-ROSTOCK (Eye Clinic of the University): "Glaucosan will not disappear from the practice because hitherto it has proven to be unequalled in its effect upon the iris if it is intended to rupture synechiae." *Klin. Wochenschr.*, No. 9, 1931.

been operated on without a successful result, a second operation ought not be to performed without a previous tentative treatment with glaucosan, either as drops, or by the even more cautious method of massage with glaucosan. I repeatedly state that acute attacks are certainly very rare in iridectomised or trephined eyes, such attacks at any rate not having become known to me. I cannot desist from quoting below the observations made by some particularly experienced ophthalmologists:

1. Dr. W. Rauh (*Zeitschr. f. Augenheilk.*, Vol. LXXIII, 1930: Acute bilateral glaucoma. Attack cured, *but tension soon rose again to* 60 (!). Glaucosan drops. Author writes: Apparently both eyes inclined to acute attacks, i.e., such eyes where attacks already obtained and were for the time being improved by pilocarpine-eserine or by a surgical operation, can be treated with glaucosan without any serious risk . . . For this reason we also treated as out-patients without any scruples three uniocular patients." (University Clinic at Giessen.)

2. Dr. Bender, former Assistant to the University Clinic at Berne, Switzerland), now Hospital Director at Breslau: R. W., who already lost his sight in the left eye in consequence of tuberculous iritis, in the right eye operated on for glaucoma three times in the course of 13 years. (Iridectomy, sclerotomy, cyclodialysis). Tension, nevertheless, frequently higher than 30, at one occasion having risen up to 55 (!), not reduced to normal by miotics. "The glaucosan treatment carried through at intervals of several months and only once every time caused the tension to drop immediately, though it has risen temporarily up to 55 mm. Hg, wherefore the tension could thereupon again be kept at a normal level for several months by a treatment with pilocarpine-eserine. No symptoms of any acute attack."

Professor C. A. Hegner, Director of the Cantonal Ophthalmological Clinic at Lucerne, Switzerland, reports: Mrs. H., aged 50 years, hysterical subject, trephined bilaterally 5 years ago for glaucoma, one eye blind. Tension 50 in both eyes in spite of miotics being applied. Glaucosan drops do not produce any attack. Glaucosan again and again reduced the tension to normal and made miotics effective, without any attack. "In such a desperate case this result must be considered excellent. Again and again the tension was reduced by glaucosan to an almost normal level and miotics were again rendered effective."

4. Dr. Iwan Enfedjeff, Ophthalmologist in Bulgaria (at Stara-Zagora), trained in Berlin (at the Charité Hospital), writes as follows: "After glaucoma operations which had no success or only a temporary one, I used glaucosan drops and never observed any attack."

I am not at all opposed to any surgical operation for glaucoma simplex, though I am considered to be such an antagonist on principle. There are certainly cases where the eye can only be saved by an operation; and now and then there are cases where an operation has a perfectly rescuing effect. In view of the reports printed above I, however, am convinced that I am right in recommending and stating as my opinion that, as far as patients already operated on without success, a tentative treatment with glaucosan ought to be carried through prior to any new surgical operation.

Even for operations in cases of complicated cataracts glaucosan drops are advisable. This indication results from the incomparably intense effect exercised by glaucosan in the following regards:

1. To dilate the pupil;

2. To contract the vessels of the iris and of the ciliary body and thus to *prevent* haemorrhage, and even secondary haemorrhage.

1. Glaucosan brings about such a considerable dilatation of the pupil that the enlargement will continue to exist even upon the aqueous humour of the eye being discharged. Therefore glaucosan was used by Jess for the extraction of a lens dislocated into the vitreous body by a contusion of the eye (this extraction having been carried out with the high-frequency pin described by him, which is sunk into the cataract. " Normal course of healing." (*Ophth. Ges.*, Kongresbericht, 1934, p. 181).

2. Upon operations on complicated cataracts and secondary cataracts the success can be perfectly obviated by haemorrhage; (and there are even cases where the operation must be discontinued, because the anterior chamber will be filled with blood). This bleeding amounts to such a danger that a special method has been described by Meller of Vienna in order to prevent it: After the incision has been made, " an appropriate pressure is to be exercised on the eye by means of the finger and a compression bandage to be applied. This procedure has the greatest influence upon the result. By the pressure the haemorrhage (from the cut vessels of the iris and of the membrane) is checked. By a haemorrhage the success of the operation would be jeopardized and in the great majority of cases would even be perfectly annihilated. It is a well-known fact that a haematoma effused in the anterior chamber of eyes affected by chronic iridocyclitis, is not liable to be easily absorbed. And even in case of the blood slowly disappearing after some weeks, the slot produced by the incision will generally be found to have again been closed by a thick membrane formed from the haematoma." (" Augenärztliche Eingriffe " [Ophthalmological operations], 2nd edition, 1921, p. 290.)

The instillation of glaucosan is a much easier method, as shown by H. Elschnig's example. (Clinic, Znaim, Czechoslovakia.) He avails himself of glaucosan just for cataracts associated with cyclitis and showing large adhesions of the iris to the lens, wherefore these operations offer great difficulties, because the adhesions by their readiness to discharge blood, render any operation difficult and dangerous. "In one of the last cases operated upon—iridectomy having been performed as a preparatory measure (an extensive agglutination of the entire iris with the mature cataract and a dense occlusive membrane nevertheless being present), I was able to prevent even the slightest trace of haemorrhage prior to and in the course of the intracapsular extraction by means of an instillation of laevorotatory glaucosan." (*Klin. Monatsbl. f. Augenheilk.*, Vol. XXXVIII., p. 194, 1937.) I received a letter from Mr. Elschnig in which he was so kind as to inform me of the favourable course taken by the three other "most serious cyclitic cataracts offering large synechiae, where laevorotatory glaucosan was instilled prior to the operation." (April 6, 1938.)*

A similar and most instructive case has been placed at my disposal by Dr. K. Leubuscher, New York.

Female patient, aged 60 years. Subsequent to the operation for cataract: iridocyclitis. Two operations made in order to extract the thick membrane of the secondary cataract proved to be unsuccessful in consequence of haemorrhage. (Both discission and lance-incision.) I advised him to instil glaucosan prior to the next operation, three times in the course of three-quarters of an hour, according to the example given by Elschnig.

Dr. L's report on the third operation:

"After incision a very minute drop of blood appeared, which, however, did not cause any difficulties whatsoever. No blood whatsoever discharged afterwards. The membrane could be removed easily and thoroughly. I am convinced that this operation would have been just as unsuccessful as the former operations, if glaucosan had not been used." (June 2, 1938.)

Recovery (sole eye) resulting in almost perfect acuity of vision: 2/3.

There is apparently no danger of any secondary haemorrhage, as the blocking of the vessels caused by glaucosan will continue to exist for a period of 1½ to 2 hours, and because after this period the small vessels have long been closed by thrombotic action.

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* "About 30 minutes before the operation I have the first instillation made, and then a second and a third time at intervals of 10 minutes. In this manner an excellent anaemia is brought about, making dispensable any cleansing by mopping. The patient mentioned in the publication enjoys excellent vision, the satisfactory success in my opinion being exclusively due to glaucosan."

ON DOUBLE VISION AFTER SQUINT OPERATION*

BY

DR. ALICE STERNBERG-RAAB

BUDAPEST

DOUBLE vision is comparatively rare after squint operations. This is to be attributed to two antithetical reasons. On the one hand, it may be due to the fact that some degree of binocular vision had been present from the very first, and that the functioning of the corresponding points was restored after the operation. If fusion is strong enough, it is able to force the eyes into a straight position even when they deviate in some degree immediately after the operation. In the opposite case there is no double vision because suppression of the image in the squinting eye is so developed that the patient fails to perceive the image even after the operation and continues to look with one eye only. Thus post-operative double vision occurs when suppression is not too strong and when, for some reason, there is an inability to fuse the two images. I should like to deal with some of the causes of such inability below.

Fusion may be prevented (1) by a post-operative abnormality in the position of the eyes; (2) by abnormal retinal correspondence; (3) by a difference in the size and shape of the retinal images in the two eyes.

I do not mention " horror fusionis " as an independent cause of inability to fuse since, according to more recent data, it is composed of the above factors 1 and 2.

(1) Post-operative double vision may therefore in the first place be caused by a squint due to the operation, and in a direction contrary to the former one, *i.e.*, divergence after convergence and *vice versa*. Double vision also occasionally occurs in cases in which the operation has been insufficient. In all cases of the kind observed by me, I found that the squint had not commenced in earliest childhood but at a time when binocular vision had presumably already been practised to a certain extent. While, in his former squinting condition, the patient had become accustomed to taking no notice of the image in one eye, he was no longer able to do this in his new condition for some time at any rate. Suppression ceased spontaneously, the image in the squinting eye presented itself, but either the patient's fusion faculty was not sufficiently developed or he had not adequate fusion amplitude to unite the two images, and double vision ensued. Post-operative double vision in such cases is in all

* From the Ophthalmic Department of the Jewish Hospital, Budapest.

probability connected with the fact that the onset of squint did not take place in earliest childhood, and that amblyopia, as I experienced, was not of too high a degree; vision not over 5/35.

The issue of such post-operative double vision seems to depend on several factors, such as the strength of the fusion power and fusion amplitude, and further on the degree and direction of the squint. In connection with the direction of the squint it may be mentioned that post-operative divergent squint is more readily overcome by the power of fusion than convergent squint of the same degree. It is generally known that fusion amplitude in convergent direction is several times that in divergent direction. When convergence power can be readily developed by training, divergence of 5 to 10° can be overcome in a physiological way. In those cases, however, where convergence faculty is deficient and cannot be developed, the patient will sooner or later rid himself of the discomfort of double vision by means of suppression, and divergence can only be eliminated with another operation. When suppression appears in cases incapable of convergence, re-operation is justified.

I mention two cases of post-operative divergence in which double vision could be changed to fusion by means of consistent exercises. The first patient originally had divergent squint, the second a convergent one.

The patient, aged 21 years, had had divergent squint of 35° since the age of 13 years. After anteposition on both sides the remaining divergence varied from 7 to 10°, and double images presented themselves. With suitable glasses and exercises, the patient learnt to blend the images. A few weeks after the operation, there were no complaints; divergence of 2 to 3° still remained a year after the operation, but the patient could easily overcome this by fusion.

The other patient had had convergent squint of 17° from the age of 12 years. After the operation performed when the patient was 18 years old, divergence of 10° and disturbing double vision appeared. A few weeks later, diplopia was on the decline but suppression could be detected. As the patient was unwilling to undergo the operation suggested, we recommended exercises with coloured glasses for the eliciting of diplopia, the voluntary approaching of the two images, their fusion from near and far, etc., which the patient carried out diligently for 4 months. At present, he still shows divergence of 6 to 8° but can straighten his eyes at will.

The situation is a far more difficult one when convergence follows upon an operation, since the divergence faculty of even a normal pair of eyes is only about 4 to 6°. Divergence faculty also can be developed but the maximum attainable does not

generally exceed this figure. The cessation of double vision may be expected by means of suppression rather than in a physiological way. In cases of post-operative convergence of less than 8° it is worth while trying divergence exercises. In squint cases of a greater degree, re-operation will be required if the patient is an adult, for the divergence faculty cannot overcome convergent squint of such a degree. Once past adolescence, a spontaneous diminution cannot be expected except during the time immediately following upon the operation. Divergence exercises cause the patient considerable strain and should therefore, unlike convergence exercises, be performed under supervision and with more precise instruments.

I shall now cite an interesting case of post-operative convergence, the curiosity of which lies chiefly in the fact that the patient had for nine years been unable to work on account of double vision, although his eyes appeared to stand parallel.

On account of divergent squint arising in his schooldays, the patient had, at the age of 25 years, been operated first on his right eye and then on his left. According to his statement, two operations had been performed on each eye. After the fourth, performed on his left eye, he had immediately experienced double vision. This disturbed him so much, more especially at a distance of over 30 cm. that he kept missing objects when he reached for them at his work. He had visited several hospitals. The double images were not typical but were due to bilateral and especially left-sided weakness of the rectus externus. The eyes appeared to be parallel. The synoptiscope showed convergence of 11 to 12° and left hypophoria of 9°. The angle gamma was positive, 5° in each eye. Binocular vision : at the first two synoptiscope examinations the patient was uncertain and projection abnormal, but after two or three macular-stimulation exercises projection became normal. At the following examination, the patient was unable to blend the images and constantly saw one of the images shifted in some direction. For this reason, the case might also have been taken for one of " horror fusionis." I have, however, experienced similar behaviour with respect to fusion images in many squint cases which afterwards attained perfect binocular vision. For this reason I tried first roughly-drawn pictures with few details, and then finer pictures. The patient's fusion faculty was completely restored and he moreover acquired good fusion amplitude. Abduction exercises produced divergence power of 5 to 6°. He actually succeeded in approaching the two images at will but not in fusing them ; the 6° divergence power could not compensate convergent squint of 12°. The patient did not tolerate prisms. Since the case thus appeared elucidated, remaining convergent squint was eliminated by advancement of

the left rectus externus. Upon this double vision ceased. He has been able to work undisturbed ever since. He used two 2° prisms transitionally at his work on account of insufficiency of convergence. At present he has convergent squint varying from 0 to 3°, with left hypophoria of 2° which he can readily overcome. Even when examined with the four dot test, the most sensitive of all to fusion deficiency, he sees four dots. The patient who, moreover, is neuropathic, has no subjective complaints and can work undisturbed.

The long duration of these complaints was evidently due to the fact that, on account of the low degree of squint measured by the perimeter, no operation had been recommended for the eye that had already been subjected to repeated operations. Moreover, it is highly probable that the post-operative convergence that was followed by double vision had been caused by over-correction due to the positive angle gamma. For when the eyes had seemed parallel, there had in fact been convergence. The conclusion to be deduced is that the angle gamma must always be taken into account in measurement of the angle of squint, more especially when we measure squint with the aid of corneal reflex images and not by exact methods.* A further point of interest in this case is that double vision had persisted for nine years without developing suppression.

(2) The cases discussed so far were those of double vision caused by post-operative squint. We may, however, find post-operative diplopia due to false projection. In these cases, the eyes are parallel or practically so. The abnormal correspondence frequently found in squinting patients may be considered a reasonable adaptation to a faulty position. To pairs of eyes that have become adapted in this way, the parallel position brought about by the operation is, as it were, the same change that is produced when initially parallel eyes take on a squinting position. The changed position of the corresponding points is apt to give rise to diplopia. In most cases double vision does not arise because normal correspondence can assert itself with the aid of the parallel position or, if not, the patient helps himself by means of suppression. Consequently when diplopia does arise, it is, in the majority of cases, of a temporary nature for, as experience shows, suppression easily develops in these cases. When, however, it is not temporary, it may endanger the success of the operation for the patient attempts to eliminate diplopia by placing his eye into its former squinting position. It is advisable to ascertain the existence of false projection before the operation. Not so much on account of the discomfort of diplopia but rather because the ideal result of restoring binocular vision can hardly be relied on

* Movements of the eyes at alternating monocular fixation.

in adults having false projection. The existence and degree of abnormal projection can be established exactly with the aid of perfect amblyoscope-like instruments such as the synoptophore, synoptiscope, orthoptoscope, etc. If the patient errs as little as 1 to 2° in adjusting the pictures placed in the apparatus, the eyes while performing monocular fixation move slightly. This movement takes place on account of the macula's adjustment to the point of fixation. It is only when the dot-like pictures stand exactly adjusted to the two maculae that the eyes remain in complete repose when there is alternating monocular fixation.

Recently Bielschowsky has been recommending the ascertaining of the existence of false projection by means of Hering's positive after images.[3] Abnormal correspondence can also be detected with the aid of the double-image test if double images can be provoked in the patient. Double images caused by false correspondence are of a paradoxical character, *e.g.*, in case of convergence they are crossed, or the distance between the two images does not correspond to the angle of squint. Frequently, however, a patient of this kind localises the double image in an uncertain manner, right at one time and wrong at another, or faulty and correct localisation rival each other. In some such cases of squint I experienced that in double-image tests the patient saw as many as three images at some moments, and of those one was fainter than the others. With the aid of the Maddox scale it is possible to ascertain, which image corresponds to the existing angle of squint, and we then draw the patient's attention to the rightly localised image and make him practise its perception with coloured glasses. In addition to macular-stimulation exercises, simpler processes such as these may also promote the restoration of normal correspondence.

It is a well-known fact that such patients see double at moments even when looking with only one eye. This is interesting from the point of view of differential diagnosis because, apart from hysteria, monocular double vision may also occur in objective alterations such as luxation of the crystalline lens, incipient choroiditis, retinitis and lesions of the visual centre.

(3) Apart from anomalies on position and abnormal correspondence, the fusion of the images in the two eyes may also be prevented by a difference in the size and shape of the retinal images (aniseikonia). I have had no opportunity of making sensitive aniseikonia tests. In the cases cited above, I carried on examinations with the Guibor's set picture marked Andrews, for an eventual difference in size of over 2 to 3 per cent.[4] Examining patients with this picture, I found no aniseikonia.

In short, I have dealt with cases coming under two classes of double vision consequent upon squint operations. One of these

is caused by the still faulty position of the eyes, the other by abnormal correspondence. In the former the task is to develop fusion amplitude, in the latter, bi-macular vision. In either case the measurement of the degree of squint and of the eventual angle gamma is of the greatest importance both before and after the operation. It is only on ascertaining these facts that one can determine the character of the double images,—whether they are paradoxical or not—and then deduce the cause of diplopia. By means of the methods already mentioned (double image test, positive after images) the right diagnosis may be arrived at without any precise instruments. If these, however, are at hand, the particulars obtained in the course of subjective examinations may be completed with objective data, such as the angle of squint and gamma, and the demonstration of false correspondence.[5] It is generally easier to overcome diplopia in post-operative divergence than in convergence. As to cases coming under the third class, I can, for want of personal experience only refer to the publications of the Dartmouth Medical School.

The cases cited above were adult patients since I have had no opportunity of observing diplopia after squint operations in childhood.

LITERATURE

1. BIELSCHOWSKY.—Congenital and acquired Deficiencies of Fusion. "An apparent horror fusionis may be due to long-lasting disuse of one eye and the fusion faculty may be capable of being developed by proper training and a most careful removal of anything which may cause an inferiority of the visual acuity of one eye." *Amer. Jl. of Ophthal.*, 1935.
2. —— Functional Disturbances of the Eyes. *Arch. of Ophthal.*, 1936.
3. —— Application of the After-Image Test in Investigation of Squint. *Arch. of Ophthal.*, 1937.
4. ALLEN.—A Simple Test for Aniseikonia by the Use of Central Fixation and Fusion. *Arch. of Ophthal.*, 1937.
5. TRAVERS, in his paper on "Suppression of Vision in Squint, etc.," published after the writing of this article, gives a simple method of detecting false projection by his Mirror Screen Test. *Brit. Jl. of Ophthal.*

ANNOTATION

The Evil Eye

The power of the evil eye is a superstition of world-wide credulity and is certainly very old, though we are not prepared to admit that the sentence in St. Matthew's gospel (xx. 15) "is thine eye evil because I am good?" is an instance in point. So far as we know our Lord was speaking in general terms and not of any gross ocular anomaly.

In Britain the belief is of great antiquity. Aubrey noted that "some person's eies are very offensive," and in Beowulf occurs the following passage (here transcribed in prose form) which seems to allude to it.

> "Now is the bloom of thy strength for a little while. Soon it will be that sickness or the sword . . . . or javelin's flight or ugly age or glance of eye shall darken thee."*

Among antiquarian odds and ends one sometimes comes across small glass balls, rather larger than a fives' ball, of brilliant colour. One in the writer's possession is a deep blue. It is said that these keep off the power of the evil eye. The folk-lore of flowers, on the other hand, ascribes all blue flowers to the dominion of Satan, so that those who are proud of their delphiniums should invest in a blue ball for purposes of indoor salvation.

In Bottesford Church, in the Vale of Belvoir, among the wonderful collection of monuments is one to the VIth Earl of Rutland. The inscription records that two of his children died in infancy by wicked practice and sorcery. The tale is that a female servant at the castle was dismissed by her employers. She, with her sister and her mother ("a monstrous malicious woman, full of oathes and curses and imprecations irreligious") set about to cast the evil eye on the earl's children. "They sickened very strangely, and after a while, died." One of the daughters of the old witch was executed at Lincoln in 1618, the mother is said to have committed suicide.†

Nowadays one supposes that some childish fatal complaint such as tuberculous meningitis would be considered in the diagnosis rather than witchcraft; but it happened long ago and was probably neither the first nor the last example of a so-called witch paying the extreme penalty for what was possibly a death from natural causes.

ABSTRACTS

I.—OPERATIONS AND THERAPEUTICS

(1) **Kirwan, Lieut.-Col. E. O'G. (Calcutta).—The surgical treatment of epidemic dropsy glaucoma.** *Ind. Med. Gaz.*, November, 1938.

(1) **Kirwan,** referring to an article by him in 1934, says that, so long as the visual fields in epidemic dropsy glaucoma show no

* From Jackson's Shropshire Folk-lore.
† The details are taken from Harrison's guide to Belvoir.

defect, immediate operation may be postponed in the hope that the general disease and with it the glaucoma will be cured before the optic nerves become permanently damaged by the increased intra-ocular pressure.

Absolute rest is essential and the patient must refrain from eating rice or mustard oil; should defects in the field become evident operation must not be delayed. He points out that temporary manoeuvres such as repeated anterior sclerotomies are not sufficient. In spite of the temporary nature of the disease it takes a considerable time to get it under control. In this disease anterior sclerotomy rarely produces a reduction of tension for more than twelve hours. Kirwan has had bad results in sclero-corneal trephining in these cases. It is true that the immediate result is satisfactory in most cases, but late results, such as a low form of irido-cyclitis, endophthalmitis, hypotony and secondary cataract have been too frequent and he now does not perform the Elliot operation in this type of case.

For the past year Kirwan has performed an anterior sclerectomy modified from the operation of Lagrange. Nearly 200 of these operations have been done to date and none of the serious late complications of the Elliot operation has been seen.

Under local anaesthesia a conjunctival flap is turned down and the sclera exposed as far as the limbus. A small keratome is passed into the anterior chamber from a spot 2 mm. from the limbus. The aqueous is allowed to escape slowly. The upper margin of the wound is depressed, allowing the root of the iris to present, and a small button-hole iridectomy is done. With gentle massage the rest of the iris returns to its place. With a pair of scissors curved on the flat a small sclerectomy is done, the portion cut off being 1 to 1·5 mm. in height and 2 mm. in breadth. The conjunctival flap is replaced and stitched with a continuous suture. This suture is removed on the fifth day. The eye is dressed on the third day and a drop of 1 per cent. atropine solution instilled. There is usually very little reaction.

Afterwards the filtering cicatrix is flat and never encroaches on the cornea. "One should remember Lagrange's advice (1937): 'Do not touch the cornea for it proliferates and do not touch the ciliary body, for it is resentful.'"

The paper is beautifully illustrated by a series of colour drawings showing the stages of the operation and an eye two weeks after operation, and a typical Elliot result to show the difference in the types of filtering scars. There is also a plate of the instruments used.

R. R. J.

(2) **Mirić, B. (Jugoslavia).—A simple operation for entropion and trichiasis following trachoma. (Ein einfaches operationsverfahren bei Entropium und Trichiasis infolge Trachoms).** *Klin. Monatsb. f. Augenheilk.*, Vol. CI, p. 381, 1938.

(2) After detailing the various operations for these conditions **Mirić** describes a simple method which he has used with good cosmetic effect in 161 cases. Briefly, it consists in making an incision on the under surface of the lid parallel to and a few millimetres away from the margin. The thick lower edge of the tarsus and the lid margin are cut through and undermined, while the free edge of the main tarsal plate is drawn down and forwards into the wound and sutured to the line of the eyelashes.

D. R. CAMPBELL.

(3) **Bergler, K. (Weissenburg).—Short-wave therapy in eye disease. (Ueber Kurzwellenbehandlung bei Augenerkrankungen).** *Zeitschr. f Augenheilk.*, Vol. XC., p. 6, 1936.

(3) **Bergler** reports on 170 cases treated with about 1,000 applications of short-wave therapy. Each application lasted 20 minutes and on an average six sittings were necessary. Good results were obtained in suppurative lesions, such as serpiginous ulcer, in post-operative inflammations and in deep keratitis. The treatment was helpful as an additional measure in herpes corneae and in ocular tuberculosis. In three operated cases of retinal detachment as in some cases of retrobulbar neuritis it appeared useful.

ARNOLD SORSBY.

(4) **Weeks, W. (New York) and Morris, S. (Marysville, California).—Induced hyperpyrexia in ophthalmology.** *Amer. Jl. Ophthal.*, p. 664, June, 1938.

(4) **Weeks** and **Morris** report the results of induced hyperpyrexia in the treatment of a few cases of gonococcal affections of the conjunctiva and iris, syphilitic lesions in the sclera, cornea, iris and uveal tract. Iritis of unknown aetiology, superficial punctate keratitis and trachoma with a purulent staphylococcal conjunctivitis. The apparatus produces an electro-magnetic field with the patient acting as a resistance, and thereby internal heat is generated.

Before treatment investigations are made of the urine, blood count, haemoglobin, non-protein nitrogen, sugar, chlorides and an X-ray of the chest is taken. A high caloric diet is given and one day before treatment 4,000 c.c. of 0·6 per cent. saline is administered by mouth. On the day of treatment breakfast is excluded, a soap enema given and a sedative prescribed.

Contra-indications are old age, organic disease of the heart and kidneys, thyrotoxicosis, anaemia and emotional and nervous instability.

The temperature is raised to 106° F. and over and during treatment the body temperature is taken per rectum and the pulse and respiration rates are recorded every five minutes. Treatment is discontinued if there are irregular fluctuations of temperature and if the pulse rises above 160 and the respiration above 45 per minute.

The number of cases treated was too small to form any definite conclusions but it seems that in gonococcal conjunctivitis the oedema of the lids and conjunctival chemosis is appreciably reduced and in gonococcal iritis the exudate in the anterior chamber disappears and the pupil dilates more fully and readily. One case of bilateral syphilitic scleritis and iritis showed a great improvement after three sessions of induced hyperpyrexia. In this anti-syphilitic treatment was not given until the pyrexia treatment was over.

The results in interstitial keratitis, syphilitic uveitis and trachoma were disappointing, no improvement occurred.

H. B. STALLARD.

II.—LENS

(1) **Luderitz, B. (Kiel).—Section ashing of the normal lens. (Ueber Schnittveraschung der normalen Linse).** *Klin. Monatsbl. f. Augenheilk.*, Vol. XCIX, p. 75, 1937.

(1) **Luderitz** prepared frozen sections of normal lenses which had been removed by intracapsular extraction immediately after death. Each section of 30μ thickness was mounted and stained with haematoxylin-eosin, and reduced to ash at 600°. The ashed section were very hygroscopic. In young lenses the inorganic substance seemed distributed equally throughout the lens. With increasing age the ash of the cortex increased, while a large amount of calcium was found in the nucleus. Phosphate occurred mostly in the young fibres of the lens.

D. R. CAMPBELL.

(2) **Urbanek, J. (Wien).—Vitamin C metabolism in cataract patients. (Der C. Vitamin Stoffwechsel dei Starkranken).** *Klin. Monatsbl. f. Augenheilk.*, Vol. CI, p. 670, 1938.

(2) **Urbanek** has estimated the amount of vitamin C in the aqueous humour, serum and lens of cataract patients. He finds that in normals the young patient is better supplied with vitamin C than the old, but not every patient with senile cataract is deficient in vitamin C. The aqueous humour contains a relatively constant amount of vitamin C and does not show the same fluctuations as the serum. The lens is not responsible for the formation of vitamin C, nor does it govern the concentration in the aqueous. Vitamin C

in the serum varied from 0·18—0·35 mgm. per cent. and with the administration of vitamin C this rose as high as 1·8 per cent. In the aqueous humour a range of 1·95—14 mgm. per cent. was found.

D. R. CAMPBELL.

(3) **Wagner, H., Richner H. and Karbacher, P. (Zürich).—Preliminary results of treatment of senile cataract with vitamin B 2 (Lactoflavin). Control with slit-lamp microscopy.** *Klin. Monatsbl. f. Augenheilk.*, Vol. CI, p. 543, 1938.

(3) The authors treated eleven patients with senile cataract, and ten normal controls for seven months with vitamin B 2 given either (*a*) as a tablet lactoflavin (Roche) twice a day, or (*b*) as 2 c.c. 0·5 per cent. solution of lactoflavin intravenously daily.

In 21 affected cases, visual acuity was improved in 10, worse in 7, and unaltered in 4, but slit-lamp observations on the same eyes showed improvement in none, a stationary condition in 9 and deterioration in 12. The authors thus conclude that vitamin B 2 cannot be considered to have any curative or prophylactic effect in senile cataract.

D. R. CAMPBELL.

(4) **Süllmann, H., and Weekers, R. (Basle).—The genesis of galactose cataract. (Beitrag zur Entstehung der Galaktose-katarakt).** *Zeitschr. f. Augenheilk.*, Vol. XCV, p. 58, 1938.

(4) **Süllmann** and **Weekers,** recalling the experimental work on galactose as an agent producing cataract, report that rats fed on glucose, sorbitol and other carbohydrates do not develop cataract. They found that rats fed on galactose take up three times as much water as control animals and excrete more. This increased intake of water is still more marked when the protein in the diet is cut down, whilst the administration of extract of the posterior pituitary had no effect. They further found that the addition of glycerine aldehyde acts as a preventative to the formation of galactose cataract; *in vitro* glycolysis of the lens is affected by the aldehyde.

ARNOLD SORSBY.

III.—MISCELLANEOUS

(1) **Gronvall, D. (Lund).—Citric acid studies referring to the eye.** *Acta Ophthal.*, Suppl. XIV, pp. VII+279, 1937.

(1) The occurrence of citric acid in the intra-ocular fluids of a wide range of animals was studied by Thunberg's method. Individual variations in the same species are small. Birds show higher values for aqueous and vitreous than mammals and fishes. In all cases the aqueous content is higher than that of the vitreous,

the two being correlated, probably in a positive way, in a number of species. Only in calves and in man is there a definite and probably positive, correlation between the citrate contents of the serum and the aqueous. The aqueous and vitreous citrate concentration is higher in the calf than in the adult animal, as also in the bovine foetus than in its dam, the difference diminishing with increasing foetal age. In human aqueous the concentration is 26-32 c.c., and is not influenced by age, sex or the presence of cataract. There was, however, a statistically significant increase in cases of iridocyclitis, glaucoma and melanotic sarcoma, as also in the secondary aqueous of rabbits. Rabbits' eyes, infected with herpes gave a lower reading. Citric acid is present in the aqueous of eyes with such severe circulatory disturbances as thrombosis and embolism; it is also present in the subretinal fluid in detachment, it is absent in the aqueous formed post-mortem. Experimentally induced hypercitracaemia raises the citrate level in the aqueous, and to a lesser degree, in the vitreous. A return to normal is parallel with the decline in the serum. The aqueous content can be increased by the instillation of tribasic sodium citrate into the conjunctival sac; absorption is greater if the corneal epithelium is abraded; the vitreous content is unaffected. Human tears contain 5-7 c.c.; mammalian retinae possess dehydrogenases for citric acid and for other substances. Occlusion of the eye reduces the citrate content of the aqueous.

ARNOLD SORSBY.

(2) **De Silva, H. R. and Robinson, P.—"Light" coloured eyes and glare sensitivity.** *Science*, p. 299, September 30, 1938.

(2) **De Silva** and **Robinson** have carried out some experimental work on light sensitivity and visual adaptation at low illuminations on 1,238 subjects, 620 of whom they labelled "light-eyes" on account of light-grey, light blue and green colour of the irides and 618 "dark-eyed" individuals with dark brown and dark blue irides. The lightness of the colour is the important factor.

The apparatus used was designed to simulate a night driving scene. The observer was confronted with two glaring lights and was required to distinguish the direction of stripes painted on a rotating test object which has its own source of illumination, the threshold of sensibility being determined by increasing the illumination on the test object until the subject is able to distinguish correctly the direction of its lines. The index of glare sensitivity was ascertained in terms of the amount of light required to perceive the lines correctly.

The results of these tests supported the conception that "light-eyed" individuals of all ages were more sensitive to glare than "dark eyed" persons and were unable to see so well under low illumination.

These facts have some practical bearing on driving vehicles at night time, when "light-eyed" drivers because of their greater susceptibility to glare and relatively poorer night vision than "dark-eyed" persons should exercise considerable care.

BOOK NOTICES

Ocular Dominance in Relation to Developmental Aphasia. By M. MACMEEKEN, M.A., B.Ed., Department of Physiology, Edinburgh University; with Appendix—"Investigation into the Binocular Vision of a series of Children with Reading Disability. By ROBERT SAMPSON, F.R.C.S.Ed. Pp. 60. University of London Press. Price, 2 shillings.

The importance of "word blindness" as a cause of reading disability in children has long been known. The present brochure is a statistical investigation of reading disability in 383 children (189 boys, 194 girls) between the ages of 7½ and 10½ years from a large primary school by Miss MacMeeken, under the aegis of the W. H. Ross Foundation for the study of the Prevention of Blindness. It would seem that the directors of the Foundation adopt a wide significance to the term "prevention of blindness." The subject, however, is one of great importance and is well worthy of scientific investigation.

Tests of mental capacity by the Stanford revision of the Binet-Simon scale led to the conclusion that the group had a mean Intelligence Quotient of 100, and probable normal range of IQ. The criterion of disability was that the Reading Accomplishment Quotient (R.A.)—*i.e.*

$$\frac{\text{Reading age}}{\text{Mental age}} \times 100 \text{ — be 85 or less than 85, } i.e.\text{, reading ability}$$

falls short of mental capacity by 15 per cent. On this criterion the incidence of disability is 9·1 per cent. (boys 12·2 per cent.; girls 6·2 per cent.). The disabilities met with revealed themselves as inability or difficulty to recognize the meaning of the combination of well-recognized letters into words; "static" reversals (*e.g.* b for d, p for q) and kinetic reversals (*e.g.* dna for and, hppaily for happily), etc. The disability may be reasonably regarded as a "developmental aphasia," and therefore essentially of cerebral origin.

Only four disability children were left-handed—an incidence of 4·4 per cent. of the 383 children, which corresponds with the normal incidence in the general population; yet it was shown that "left-handedness and reading disability run in families, and in such families there is heavy incidence of left-handedness."

Most surprising of all was the significant relation between reading disability and left-eyedness, which is stated to have been "long realized." "Every one of these disability children was found to be left-eyed." This is certainly a result which would not have been anticipated on theoretical grounds; for the defect is clearly of cerebral origin, and each eye is, from the neurocerebral point of view, a bilateral organ, even the macular region itself, which is almost alone involved in reading, being innervated from both occipital lobes. In this connection it is interesting to note that Dr. Sampson found no outstanding defect of the binocular vision sufficiently common to suggest even a contributory causal relationship to reading disability. It is true that he examined only 36 cases. Of these the left eye was dominant in 15 cases (four squints), the right eye in six cases (one squint) and no definite dominance existed in 15 cases. There seems to be some discrepancy here between Dr. Sampson's and Miss MacMeeken's results.

NOTES

University of Oregon Medical School

THE well known veteran ophthalmologist, Dr. John E. Weeks, has by his generous gift of $100,000 made it possible to establish a library at the University of Oregon Medical School. His recognition of the need of these new facilities has prompted others to add to the fund, and it is felt that the entire project typifies the spirit of advancement in the field of medicine. Physicians throughout the Pacific Northwest will benefit by these improved library facilities.

A committee appointed by Dean Dillehunt to consider suitable recognition of the munificence of Dr. Weeks and to raise the necessary funds for this work is proposing treatment of the entrance hall including a bas-relief of the donor. The plan is dependent, therefore, upon cash contributions from Dr. Weeks' many friends and admirers to cover the project costs.

Those who wish to make a donation to this fund should make their cheques payable to Ralf Couch, Treasurer, Weeks Library Fund, University of Oregon Medical School, Portland, as soon as possible inasmuch as the art work should start at once.

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North of England Ophthalmological Society

A SLIT-LAMP COURSE open to all ophthalmic surgeons will be held at Sheffield from September 25 to 29, 1939. Lecturers: Mr. Harrison Butler and Mr. Basil Graves. Further particulars from the Hon. Secretary, Mr. Percival J. Hay, 350, Glossop Road, Sheffield 10, to

whom all applications, accompanied by the remittance of the fee for the course should be made. Fee: Five guineas.

* * * *

Appointment

Mr. A. RUGG-GUNN has been appointed visiting ophthalmologist to the Central Middlesex County Hospital.

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The Australian Ophthalmological Society's Annual Congress

THE first session of the Australian Ophthalmological Society was held in Melbourne in April, 1939. The Lieutenant-Governor of Victoria opened the proceedings and Dr. James Flynn took the chair in the absence, through illness, of Sir James Barrett, the President. Dr. Flynn read Sir James Barrett's paper on blindness and the history of the Braille type.

Miss Ida Mann gave a lecture on developmental abnormalities of the eye; other papers included those of Mr. Bruce Hamilton on birth injuries of the eye and Dr. Trethewie on the influence of acetyl-choline on the tissues of the eye. This concluded the first day's session.

On the following day Miss Mann gave another paper on abnormalities, and Dr. Niall one on progressive exophthalmos. The latter paper led to an important discussion, The afternoon was occupied by demonstrations on ocular histology and comparative anatomy by Dr. Kevin O'Day and Dr. Willis.

Visits to the Royal Victoria Institute for the Blind and to the Royal Melbourne Hospital completed the congress.

FUTURE ARRANGEMENTS

1939

October 6.—Midland Ophthalmological Society, at Birmingham and Midland Eye Hospital. (Annual.)

CONTEMPORARY OPHTHALMIC LITERATURE

Archives of Ophthalmology. *June, 1939.*

SLOAN. Instruments and technics for the clinical testing of light sense: Review of recent literature.

HAGEDOORN. Angioid streaks.

LEECH. Reduction of post-operative complications in cataract operations with corneo-scleral sutures.

PFEIFFER. Treatment of diseases of the eye with Grenz rays.

KOCH and PRANGEN. Marked anisometropia: report of a case in which full correction was accepted.
SMITH. Significance of false projection in treatment of squint.
WHITE and BROWN. Occurrence of vertical anomalies associated with convergent and divergent anomalies: a clinical study.
YASKIN. Paralysis of the extraocular muscles: clinico-anatomic considerations: report of cases of paralysis of the oculomotor and abducens nerves due to unusual causes.
TOWN. Contact glasses for correction of refractive errors in monocular aphakia: production of binocular single vision.
KRAUSE and TAUBER. Creatine and creatinine of the ocular tissues.

American Journal of Ophthalmology. *June, 1939.*

FINE. Gumma of the orbit.
BIELSCHOWSKY. Lectures on motor anomalies. X.Supranuclear paralyses.
JACKSON. Tonometry and unusual cases of glaucoma.
LUCKIESH and MOSS. Frequency of blinking as a clinical criterion of ease of seeing.
WALKER. Fuso-spirochetal infection of the eye and orbit.
BERENS and LOUTFALLAH. Aniseikonia. A study of 836 patients examined with the ophthalmoeikonometer.
KUHN. Adrenal neuroblastoma and its ocular symptons. A case report with autopsy.
THYGESON. Cultivation in vitro of human conjunctival and corneal epithelium.
FERREE and RAND. Testing fitness for night flying. Speed of change of adjustment of the eyes for intensity of light and distance of object.

Klinische Monatsblätter für Augenheilkunde. *June, 1939.*

TRENDELENBURG. An anomaloscope adapted to light quality and the question of the transitional fall between the norm and the protanomaly.
SCHMIDT. The temperature in healthy and diseased rabbits' eyes after various therapeutic measures.
SZINEGH. Our experience with electricity in the treatment of ophthalmic gonorrhoea.
SPIRATOS. Infectious diseases of the eyes in Greece.
WINKLER. Carbolic cauterization of both eyes and general consequences together with remarks on the therapy of ocular cauterization.
VON HERRENSCHWAND. Optic nerve obstruction in post vaccinial encephalomyelitis.
CIBIS. Contribution to the transmission of familial optic atrophy. (Leber's disease).
GORDURAN and SOHR. Histological and clinical researches on sympathetic ophthalmitis.

Zeitschrift für Augenheilkunde. *June, 1939.*

REDSLOB. Teeth and the optic nerve.
IGERSHEIMER. Is glaucoma influenced by the transudation of the retinal vessels?
WEEKERS. Lens survival according to the Haan-Bakker method. Composition of the perfusion liquid.
KARBOWSKI. Iontophoresis in ophthalmology.

Annali di Ottalmologia e Clinica Oculistica.

VENCO. Research on the chemico-therapeutic activity of para-aminophenylsulphomide in experimental microbic ocular infections.
SALA. Ocular alterations from Stovarsol sodium.
BASILE. Experimental dinitrophenol cataract.

Archivio di Ottalmologia. *March-April, 1939.*

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KARPE. The axial displacement of the lens pole in accommodation.
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